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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

TWENTY-THIRD REPORT

OF THE

STATE ENTOMOLOGIST

OF

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W. E. BRITTON, Ph.D.
State Entomologist

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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February, 1924

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BULLETIN 256

TWENTY-THIRD REPORT

OF THE

State Entomologist of Connecticut.

To the Director and Board of Control of the Connecticut Agricultural Experiment Station.

I have the honor to transmit, herewith, my twenty-third annual report as State Entomologist of Connecticut. Except for the financial statements which cover the fiscal year ending June 30, 1923, this report relates the activities of the department for the calendar year of 1923. It contains the usual somewhat detailed account of work prescribed by the Statutes, such as nursery and apiary inspection, mosquito elimination and gipsy moth suppression. The account of the gipsy moth work is given in condensed form. The results of studies of the raspberry fruit worm by Mr. B. H. Walden, have already been published as Bulletin 251, and of the European red mite, by Dr. Philip Garman, as Bulletin 252 of this Station. Special papers in this report deal with the results of experiments in dusting *versus* spraying apple orchards in 1923, the European corn borer, Oriental peach moth, the Asiatic beetle, the larch case-bearer, further experience with paradichlorobenzene as a remedy for peach borers, tests of sodium hypochlorite for the control of American foul brood of bees, swarms of aphids, and notes on miscellaneous insects.

Respectfully submitted,

W. E. Britton,

State and Station Entomologist.

INSECT PEST ACCOUNT.

Report of Receipts and Expenditures of the State Entomologist.

From July 1, 1922 to June 30, 1923.

Receipts.

From E. H. Jenkins, Treasurer	$13,025.34	
Account of 1922, Balance	1,089.53	
State Comptroller, Gipsy Moth Account	218.80	
Interest on Bank Deposits	42.31	
Various Sources (automobile mileage)	49.02	
		$14,425.00

Expenditures.

For Salaries and Wages	$8,111.28	
Printing and Illustrations	363.13	
Postage	17.77	

Stationery	$ 211.51	
Furniture and Fixtures	127.95	
Library (Books and Periodicals)	1,011.93	
(Binding)	8.10	
Laboratory Supplies	692.38	
Spraying Supplies	105.00	
Machinery, Tools and Supplies	255.73	
Scientific Apparatus	593.16	
Express, Freight and Cartage	32.11	
Automobiles: Insurance	105.71	
Supplies and Equipment	175.88	
Repairs	218.72	
Gasoline	199.25	
Oil	64.05	
Traveling Expenses	267.07	
Miscellaneous	785.88	
Telephone and Telegraph	1.55	
Heat and Light	1.00	
Rental and Storage	42.85	
Balance, Cash on Hand	1,032.99	
		$14,425.00

Memorandum.—This account has been audited by the State Auditors of Public Accounts. The item of $218.80 received from the State Comptroller is in effect a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in the work of inspecting imported nursery stock. The item of $785.88 under miscellaneous expenditures includes interest on bank balances, automobile mileage and other miscellaneous receipts paid over to the Station Treasurer and by him returned to the State Comptroller.

Summary of Inspection and Office Work.

224 samples of insects received for identification.
114 nurseries inspected.
108 regular certificates granted.
85 duplicate certificates furnished to be filed in other States.
60 parcels of nursery stock inspected and certified.
31 orchards and gardens examined.
35 shipments, containing 179 cases, 1,981,895 plants, imported nursery stock inspected.
15 shipments or 42.8 per cent. found infested with insects or fungi.
725 apiaries, containing 6,802 colonies inspected.
17 apiaries and 25 colonies found infested with European foul brood.
7 apiaries and 22 colonies found infested with American foul brood.
2,283 letters written on official work.
663 circular letters.
368 post cards.
53 reports to Federal Horticultural Board.
857 bulletins, etc., mailed on request or to answer inquiries.
86 packages sent by mail or express.
19 lectures and addresses at institutes, granges and other meetings.

Publications of the Entomological Department, 1923.

By W. E. Britton:

Twenty-second Report of the State Entomologist of Connecticut (Bulletin 247) 118 pages, 8 figures, 16 plates; 10,500 copies distributed in October, 1923.

The Aleyrodidae and Coccidae of Connecticut. Reprinted from Bulletin No. 34, Connecticut Geological and Natural History Survey, 48 pages, 3 figures, 4 plates, June, 1923.

The European Corn Borer Quarantine, Bulletin of Immediate Information No. 25, 5 pages; 3,000 copies, June, 1923.

The Apple and Thorn Skeletonizer, Bulletin of Immediate Information No. 26, August 15, 1923.

Registration of Bees, Bulletin of Immediate Information No. 27, 200 copies, September 15, 1923.

The Apple and Thorn Skeletonizer, Proceedings 32nd Annual Meeting Connecticut Pomological Society, page 21, 1923.

Rapid Spread of the Apple and Thorn Skeletonizer, *Hemerophila pariana* Clerck, Journal of Economic Entomology, Vol. 16, page 207, April, 1923.

The Gipsy Moth, Proceedings of Conference at Albany, N. Y. November 16, 1922, Bulletin 148, New York State Department of Agriculture, page 44, December, 1922.

Swarms of Aphids, Journal of Economic Entomology, Vol. 16, page 395, August, 1923.

Report of Committee on Injurious Insects, Proceedings 32nd Annual Meeting, Connecticut Pomological Society, page 5, 1923.

The Arbor-Vitae Leaf-Miner, Tree Talk, Vol. 5, No. 2, page 24, 1923.

The Work of the State Entomologist, Hartford Daily Courant, Sunday, October 21, 1923.

Insects Attacking Vegetable Crops in 1922 (Insect Part of Report of Committee on Diseases and Insects), Report of Connecticut Vegetable Growers Association for 1922, page 83.

Recent Developments in the Use of Insecticides, Part II, Bulletin 242, page 163.

By W. E. Britton and G. P. Clinton:

Spray Calendar, (Bulletin 244) 44 pages with card, illustrated, 11,500 copies, May, 1923.

The Winter Pruning of Fruit Trees, Bulletin of Immediate Information, No. 19, March 14, 1923.

Dormant Sprays on Orchard Trees, Bulletin of Immediate Information No. 20, March 21, 1923.

The Pink Spray for Apple Orchards, Bulletin of Immediate Information No. 22, May 1, 1923.

The Calyx Spray for Apples and Quinces, Bulletin of Immediate Information No. 24, May 21, 1923.

By W. E. Britton et al: The Hemiptera of Connecticut, Bulletin No. 34, Connecticut Geological and Natural History Survey, Projected and Edited by W. E. Britton. Text by J. F. Abbott, A. C. Baker, H. G. Barber, W. E. Britton, W. T. Davis, D. M. DeLong, W. D. Funkhouser, H. H. Knight, A. C. Maxson, Herbert Osborn, H. M. Parshley, E. M. Patch, L. A. Stearns, J. R. de la Torre-Bueno, E. P. Van Duzee and H. F. Wilson; 807 pages, 169 figures, 20 plates, June, 1923.

By M. P. Zappe and E. M. Stoddard:

Results of Dusting *vs.* Spraying in Connecticut Apple and Peach Orchards in 1922 (Bulletin 245), 17 pages, June, 1922.

Comparative Results of Spraying and Dusting on Apples and Peaches, Proceedings 32nd Annual Meeting Connecticut Pomological Society, page 30, 1923.

By Philip Garman:

Work with the Control of the European Red Mite in 1922. Proceedings 32nd Annual Meeting, Connecticut Pomological Society, page 13, 1923.

Notes on the Life History of *Clastoptera obtusa* and *Lepyronia quadrangularis*, Annals Entomological Society of America, Vol. XVI, page 153; 10 pages, 1 figure, 1 plate, June 1923.

By B. A. Porter and Philip Garman:
The Apple and Thorn Skeletonizer, Bulletin 246, 20 pages, 3 figures, 4 plates, June, 1923.

By Samuel T. Sealy:
Recent Development of Mosquito Work in Connecticut, Proceedings of the Ninth Annual Meeting of the New Jersey Mosquito Extermination Association, page 94, 1922.
Accomplishments in the Past Year in Anti-Mosquito Work in Connecticut, Proceedings of the Tenth Annual Meeting of the New Jersey Mosquito Extermination Association, page 91, 1923.

DEPARTMENT STAFF AND WORK.

W. E. Britton, Ph.D., *State and Station Entomologist.*
B. H. Walden, B.Agr., *Photographic and General Work.*
M. P. Zappe, B.S., *Inspection and General Work.*
Philip Garman, Ph.D., *Research Work.*
} *Assistant Entomologists.*
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Samuel T. Sealy,[1]
Robert C. Botsford,[2]
} *Deputy in Charge of Mosquito Work.*
Miss Gladys M. Finley, *Clerk and Stenographer.*

H. W. Coley, Westport,
A. W. Yates, Hartford,
} *Apiary Inspectors.*

Mr. Samuel T. Sealy, who has served as Deputy in charge of mosquito work for three years, resigned to take effect April 1, 1923. Mr. Walden was placed in charge of this work temporarily. Mr. Robert C. Botsford was employed to work with Mr. Walden and on becoming familiar with the situation was appointed Deputy July 1.

Mr. J. Leslie Rogers was employed from July 1 to December 1 to aid in inspecting nurseries and after that work was finished, to search for the European corn borer. Mr. T. F. Cronin was employed from June to September as assistant in inspection of nurseries. Mr. M. J. Hubbell was employed during November in the construction of the addition to the insectary and in building some out-door breeding cages.

Besides giving his attention to the mosquito control for three months, Mr. Walden was able to complete his studies on the raspberry fruit worm, the results of which have been published as Bulletin No. 251.

Dr. Garman has continued with experiments to control the European red mite, *Paratetranychus pilosus* Can. & Fanz., and his results of four seasons' work in Connecticut against this pest have been published as Bulletin 252. Dr. Garman has given considerable attention to a study of the mites, has worked with Mr. Zappe on the investigations of the plum curculio on apple and *Anomala*

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[1] Resigned April 1.
[2] From July 1.

orientalis, and has completed the manuscript of a monograph of the Odonata or Dragon Flies of Connecticut to be published in the near future by the State Geological and Natural History Survey.

Mr. Zappe has been in charge of the inspection of nursery stock, and of scouting for European corn borer. In co-operation with Mr. E. M. Stoddard of the Botanical Department, Mr. Zappe has continued the tests of various dusts in comparison with sprays in apple and peach orchards for the control of the various insects and fungous pests. The work this year was chiefly for the purpose of trying some of the new copper dusts, but in most cases insecticides were added and the results so far as they relate to insects may be found in the following pages of this report.

Dusts were also applied to potatoes at the Station Farm in comparison with the usual spray of Bordeaux mixture and lead arsenate. Mr. Zappe has further experimented with Paradichlorobenzene as an agent in controlling the peach borer.

The plum curculio, *Conotrachelus nenuphar* Hbst., has proven a serious pest of apples in Connecticut, often disfiguring a large proportion of the fruit and is seemingly difficult of control. In order to learn more of its habits and to devise some more effective control methods a five-year program has been adopted. Some progress has been made during the past season by Messrs. Zappe and Garman.

The gipsy moth control work has been continued as for the past few years, the field work being in charge of Deputy John T. Ashworth, aided by his Assistant, Mr. J. A. McEvoy. About twenty-five other men have been kept busy throughout the year in scouting for egg-masses and larvae, and in spraying during the latter half of May and June. This work is performed in co-operation with the Federal Bureau of Entomology.

The apiary inspection work has been done as in past years by Messrs. H. W. Coley and A. W. Yates on a *per diem* basis.

The Entomologist, besides directing the work of the Department and attending to the correspondence of the office, has continued to serve as Associate Editor of the Journal of Economic Entomology, and as Chairman of the Tree Protection Examining Board. He has also continued to aid the Federal Bureau of Entomology by gathering data and submitting reports for the Insect Pest Survey. Several years ago he organized and projected the work on the Hemiptera of Connecticut, which has just been published as Bulletin No. 34 of the State Geological and Natural History Survey; he is the author of that portion dealing with the white flies (*Aleyrodidae*) and scale insects (*Coccidae*) and has edited the entire volume of 807 pages. Some of the drawings for the text figures were done by Dr. Garman and the photographs were arranged and most of them made by Mr. Walden. The index and much of the proof reading was done in this office and altogether considerable attention has been given to it during the year.

New Equipment.

During the year the equipment of the Department has been substantially increased. A new insectary 10 x 20 feet with boarded roof and sides covered with cottage wire netting has been built at the Station Farm at Mount Carmel, and has already been used in connection with the plum curculio investigations on apple. The out-door insectary at the Station, which was 10 x 16 feet in size with shingled roof has been moved about one hundred feet northward, and an addition 12 x 14 feet built, with glass roof and sides covered with chicken wire netting. The original portion has the sides covered with fine mesh copper wire, and will be kept as a separate compartment. Both insectaries are shown on Plate IX.

Two new binocular microscopes (one of portable type) and a Bausch & Lomb photomicrographic stand with accessory lens and lighting equipment, and a Wales adding machine have been purchased for the laboratory. A new self-recording thermometer was also obtained to use in the insectary.

Several important additions have been made to the library, including the insect portion of the Biologia Centrali-Americana and a complete set of the Bulletin of Entomological Research of England.

ENTOMOLOGICAL FEATURES OF 1923.

The season has been abnormal and quite the opposite of 1922, in that little rain fell between July 1 and October 1. Many crops were below the usual yield on account of the drought. Particularly were apples under size. The first of the season was cool and moist and there were several hard frosts in April, but no early hard frosts in the fall.

Perhaps the most outstanding features of the season, so far as insects are concerned, were the general injury of apple trees in July by the apple and thorn skeletonizer, *Hemerophila pariana* Clerck, which caused nearly all unsprayed apple trees throughout the central part of the State to turn brown, the increase in the Oriental peach moth, *Laspeyresia molesta* Busck, and the discovery of the European corn borer, *Pyrausta nubilalis* Hubn., in Groton in October and in East Lyme in December.

There has been no important increase in the territory infested by the gipsy moth as was the case in 1921, caused by wind-spread, though a few additional towns were found by Federal scouts to be infested. For this reason the towns of Goshen, Litchfield, Cheshire, Meriden, Middlefield, Wallingford, Old Lyme and Old Saybrook have been placed under Federal quarantine.

The brown-tail moth has not again appeared in Connecticut, and not a single nest has been seen since 1919.

Fruit Insects.

The pear psylla, *Psylla pyricola* Forst., caused the usual amount of damage and was particularly prominent in a pear orchard in Southington in July.

The San José scale, *Aspidiotus perniciosus* Comst., is somewhat on the increase, though no such serious injury has been seen in Connecticut as has been reported from southern Illinois and Indiana.

The false apple red bug, *Lygidea mendax* Reut., was not prominent and generally caused less injury throughout the State than usual.

The pear leaf blister mite, *Eriophyes pyri* Pagst., was received from Hamden and Waterbury.

The European red mite, *Paratetranychus pilosus* Can. & Fanz., was responsible for rather wide-spread damage to Baldwin apple orchards during the season, probably more than in 1922. The results of Dr. Garman's experiments for the control of this pest may be found in Bulletin 252.

The rosy apple aphid, *Anuraphis roseus* Baker, caused less damage than usual though some injury was reported from Haddam and Deep River. Eggs were rather abundant on the fruit spurs in March about New Haven.

The green apple aphid, *Aphis pomi* DeGeer, was present on water-sprouts and terminal shoots, in usual abundance.

The rose leafhopper, *Empoa rosae* Linn., seemed to be more abundant than usual on apple trees, and on May 8, nymphs had just hatched from eggs at Milford.

The rose chafer, *Macrodactylus subspinosus* Fabr., was scarce in some localities and abundant in others and injured the developing fruit by eating holes in it.

The tarnished plant bug, *Lygus pratensis* Linn., caused some injury to the terminal twigs of apple and peach nursery stock and its work was observed in several nurseries in different parts of the State early in August.

The tent caterpillar, *Malacosoma americana* Fabr., is still increasing and may be expected to be very abundant throughout the State in 1924. Eggs are now present everywhere on the twigs of apple and wild cherry. During the year specimens of this insect were received from Clinton, Southport and Washington, with special reports from Danbury, Meriden and Mansfield, and from Fairfield, Litchfield and Windham Counties.

The apple maggot or railroad worm, *Rhagoletis pomonella* Walsh, was fully as abundant as usual though in our experiments, apples sprayed or dusted with lead arsenate after July 1 were almost free from injury. Specimens were received from New Haven, Cheshire and Berlin.

The plum curculio, *Conotrachelus nenuphar* Hbst., was more

abundant than in the average season and caused much injury to apples.

The Oriental peach moth, *Laspeyresia molesta* Busck, was more abundant than it has ever been before in Connecticut. The larvae tunneled in the twigs of peach trees, and were found in the fruit late in the season. This insect was first found in Connecticut at Stamford by Federal scouts in 1918, and it is not known to occur anywhere in the State except in Fairfield and New Haven Counties. In 1923 a few infested peaches were found at the Station Farm at Mount Carmel.

A cocoon of the bag worm, *Thyridopteryx ephemeraeformis* Haw., on quince was received from New Haven, May 1. The eggs hatched and the larvae were fed and reared to maturity and the adults obtained.

The grape vine tomato gall, *Lasioptera vitis* O. S., was abundant as usual, and specimens were received from West Hartford, June 14, and from New Britain, June 19.

The red-humped caterpillar, *Schizura concinna* S. & A., was present in usual numbers, and specimens were received from Bloomfield, July 16, and from East Hampton, August 14.

Vegetable Insects.

On account of the cool and damp weather in May and June the seed did not germinate promptly and there was considerable injury by the seed corn maggot, *Hylemyia cilicrura* Rond. One field of corn in Milford was seriously injured in June.

Wireworms (Elateridae) caused damage of varying extent in three fields of corn on one farm in Woodbridge, visited on July 6. In one small field 50 per cent. of the corn had been destroyed.

Cutworms caused the usual amount of injury throughout the State, but serious injury to tobacco plants was reported from Portland, June 22, where there was 15 per cent. damage. The owner used poisoned bran mash, but also poisoned the plants and practiced hand-picking.

There was, perhaps, more than the usual amount of injury from the stalk borer, *Papaipema nitela* Guen. Records of injury to corn came from Somers, Torrington, Waterbury, Hamden and Derby. In Windsor it attacked tobacco, and in Stratford, tomatoes and peppers. This insect occurs over the entire State, and may tunnel in any kind of herbaceous stem—even weeds. No remedy is known other than destroying the borers when found.

The corn ear worm, *Chloridea obsoleta* Fabr., was present in a number of fields late in the season, as it was in 1922, but was nowhere nearly so abundant as in 1921.

The turnip aphid, *Aphis pseudobrassicae* Davis, killed or seriously injured turnips and kale in many parts of the State in June, July and August. Specimens were received from Meriden, Danbury, Harwinton, Hamden and New Haven.

Colonies of the cabbage aphid, *Brevicoryne brassicae* Linn., started on cabbages in New Haven and did some damage, but later disappeared.

The pea aphid, *Illinoia pisi* Kalt., was also present on garden peas and caused perhaps the usual amount of damage. This damage was serious in some fields, one grower near New Haven reporting a total loss on three acres. In certain parts of Hartford County, a forty per cent. infestation was observed on June 22, and reported by County Agent Southwick.

The potato aphid, *Macrosiphum solanifolii* Ashm., also appeared in many fields and caused considerable injury. Samples were received from Wallingford on July 30, with the tips badly infested. At the Station Farm, Mount Carmel, a potato field was moderately infested, though the bulk of the aphids came later in the season than usual. They were abundant on August 7, but by August 24 had all disappeared.

The squash vine borer, *Mellitia satyriniformis* Hubn., the squash bug, *Anasa tristis* DeGeer, and the striped cucumber beetle, *Diabrotica vittata* Fabr., were all present in usual numbers, the last being reported as being very abundant at Storrs on June 22.

Considerable injury resulted from the attacks of the potato or cucumber flea beetle, *Epitrix cucumeris* Harr., and four per cent. damage in Woodstock on June 19, was reported by County Agent Davis.

In September, tobacco fields were severely injured by having the leaves partially eaten by the red-legged grasshopper or locust, *Melanoplus femur-rubrum* DeGeer. This damage was estimated as amounting to between forty and sixty per cent.

The brown colaspis, *Colaspis brunnea* Fabr., caused some injury in Hamden and Durham by feeding upon the leaves of beans. The observations were made by Mr. Zappe.

The European corn borer, *Pyrausta nubilalis* Hubn., was discovered at Groton by Federal scouts on October 25, 1923, and a few days later another small infestation was found farther eastward in the same town. All corn stalks, weeds, grass and rubbish on these small fields was burned. On December 14, another small infestation was found by Federal scouts in the village of Niantic, township of East Lyme. These infestations are described more in detail on page 278.

The Asiatic beetle, *Anomala orientalis* Waterhouse, which was discussed in last year's Report, pages 277 and 345, has caused considerable damage to lawns in the vicinity where the adult beetles were first discovered. The larvae eat the roots of the grass, killing it. A more complete account of this introduced pest will be found in the following pages of this Report.

White grubs devouring the grass roots of a lawn in Salisbury were sent by the owner to the Bureau of Entomology at Washington, and identified by Dr. Boving as *Anomala marginata* Fabr.

This is a species occurring in the southern Atlantic States and was not known to be present in Connecticut. Mr. Zappe visited the place and gathered material on September 25, and an attempt will be made to rear the adults.

Shade Tree and Forest Insects.

The woolly maple leaf scale, *Phenacoccus acericola* King, continues to infest sugar maple trees in villages and cities, but has not been observed in abundance on maple trees in the open country. Specimens were received from New Haven, Thompsonville and Norwalk.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., is without doubt the commonest scale insect in Connecticut, and infests not only shade and forest trees but also fruit trees and ornamental shrubs. It is the commonest insect found by inspectors in nurseries, and though perhaps not more abundant than usual, it seems to be fairly abundant year in and year out. As a rule, the growers pay little attention to it, except to destroy infested stock in nurseries when directed to do so.

The arbor-vitae leaf-miner, *Argyresthia thuiella* Pack., which caused considerable injury to arbor-vitae trees and hedges around New Haven in 1921 and much less in 1922, was not injurious in that region in 1923, though it was reported as causing serious damage to trees in New Canaan and Stamford.

The white pine weevil, *Pissodes strobi* Pk., still continues to injure small trees in the open with marked regularity. Specimens were received from Southington, Kensington and Windsor.

The imported pine sawfly, *Diprion simile* Hartig, is present here and there but not in great abundance. Specimens were received twice from New Haven during the season, and the insect was reported from Deep River.

The elm leaf beetle, *Galerucella luteola* Müll., caused more injury than last year throughout the State, but it was particularly severe in Fairfield County, and its work was observed in Glastonbury and Wethersfield.

The imported poplar and willow beetle, *Plagiodera versicolora* Laich., which first appeared in the State in Greenwich and Stamford has spread eastward and is now found in New Haven and Yalesville. Some of the infested trees in Greenwich were entirely defoliated.

The oak leaf-roller, *Tortrix quercifoliana* Fitch, was prevalent particularly around Hartford and Stamford on pin oaks. Certain trees in the vicinity of Stamford were nearly defoliated.

The larch leaf-miner, *Coleophora laricella* Hubn., was prevalent in some parts of the State and nearly defoliated the larch trees in June. Specimens were received from Canaan and New Canaan and the work of this insect was observed elsewhere.

The spruce leaf-miner, *Recurvaria piceaella* Kearfott, was received on May 7 from New Canaan, where it was causing some injury.

The larch leaf aphid, *Chermes strobilobius* Kalt., was present on larch leaves, especially of the European species. Specimens were received from New Canaan, June 7, and the writer observed this insect in New Haven.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, continues to infest the leaves of several species of pines in sheltered situations. It was received from Manchester, August 22.

The beech leaf aphid, *Phyllaphis fagi* Linn., is nearly always present on the leaves of the European beech, especially the purple leaved form known as the copper beech. Specimens were received from Danbury, May 29.

Two periods of aphid swarming occurred in the cities of the State, one in June and the other in September. The June swarms consisted of *Euceraphis deducta* Baker, and the September swarms were *Aphis betulaecolens* Fitch. Both species infest birch trees and no doubt they came from the gray birches which grow abundantly in most parts of the State. They are certainly common near New Haven, Bridgeport and Waterbury where these swarms were particularly noticeable.

Late in the season willow trees throughout the State were infested with brown aphids, *Melanoxantherium* sp. Mr. Zappe observed them especially in New Canaan, Darien, Woodmont, Yalesville, Cromwell and Manchester, while inspecting nurseries, and the writer saw them on a large willow tree in New Haven on August 30. The twigs were covered with large brown wingless aphids, and thousands of such aphids were crawling about on the fence, porch posts and rails and on the painted woodwork of the house. Wherever an aphid was crushed there was a purple stain, and these aphids in such abundance were a perfect nuisance. Honey dew had dripped from the branches upon the grass and fence underneath and both the tree and the ground were fairly swarming with bees, wasps and flies, attracted by the honey dew. The owner was advised to spray his tree and house with nicotine solution and soap to kill the aphids.

A woolly aphid, *Prociphilus tessellata* Fitch, on maple, was received from Torrington, July 30.

The walnut caterpillar, *Datana integerrima* G. & R., was reported as being common at Chester in early fall.

The European pine shoot moth, *Evetria buoliana* Schiff, was received from Tarrytown, N. Y., on October 3, and from Ridgefield on November 24. This insect had attacked the Norway or red pine and its shoots were crooked and deformed as is characteristic of the injury caused by this insect.

The birch leaf skeletonizer, *Bucculatrix canadensisella* Chamb., was fully as abundant as in 1922 and defoliated birch trees here

and there throughout the State. Many thought it to be the same insect which skeletonized the apple trees.

The fall canker-worm, *Alsophila pometaria* Harr., was rather abundant in some localities and the larvae fed upon the leaves of shade, forest and fruit trees. Around Saybrook and New Haven, this injury was rather prominent, and apple, elm, poplar, birch and walnut (*Juglans*) leaves were eaten. During November and December the gray male moths were unusually common, fluttering about the base of trees, and we may expect considerable injury from this insect next season. The females have no wings and must crawl up the trunks of trees to lay their eggs. Only early spraying with some arsenical poison will prevent damage next season.

The fall web-worm, *Hyphantria cunea* Drury, which makes nests on the ends of branches the latter part of the season was also especially prominent in Hartford, Tolland, Windham and New London Counties. Specimens were sent in from East Granby, Meriden and Plantsville. Roadside, woodland and fruit trees were attacked and many were entirely defoliated.

Miscellaneous Insects.

The house centipede, *Scutigera forceps* Raf., was sent to the office October 2 from Southport, where it annoyed the inmates of a dwelling house.

The basement of an apartment house in New Haven became overrun by the European cricket, *Gryllus domesticus* Linn., and both owner and tenant applied to the writer in April for advice.

The black carpet beetle, *Attagenus piceus* Oliv., causes considerable damage each year by eating holes in clothing hanging in closets. During the season specimens were received from Meriden and Farmington. If small pieces of wool cloth are kept on the floor, the larvae will often feed upon them instead of attacking the clothing.

The chrysanthemum gall midge, *Diarthronomyia hypogaea* Loew., was sent to the Station, April 10 from some commercial greenhouses at Rowayton where the small potted plants had galls on the leaves.

A small leaf beetle, *Nodonota puncticollis* Say, was reported as eating the buds of roses in Bridgeport, June 19, and specimens were sent to the office.

The Euonymus scale, *Chionaspis euonymi* Comst., was received from New Haven on April 3 on *Pachysandra terminalis*, a low-growing evergreen plant used in shady situations by landscape gardeners. This is the first time that I have ever seen this plant infested.

The four-lined leaf bug, *Poecilocapsus lineatus* Fabr., was common in 1923 and attacked the growing tips of many different

kinds of plants. Specimens were received on currant from Hamden, June 23, on currant and chrysanthemum from West Haven June 26, and on peony and spearmint from Stratford, July 2.

The rhododendron borer, *Sesia rhododendri* Beut., described in the Report of this Station for 1922, page 347, is still causing injury in rhododendron plantations and the growers are interested in methods of controlling it. Specimens were received from Yalesville, June 16 and from Springfield, Mass., June 28.

Geranium plants were received from New Haven, August 3 which had been injured by white ants, *Reculitermes flavipes* Kollar. The ants had tunneled in the stems ruining some of the plants.

On November 23, specimens of box twigs were received from Waterford. The leaves were badly infested with larvae of the box leaf-miner, *Monarthropalpus buxi* Labou. If possible some experiments will be conducted for the control of this pest.

Larkspur plants on the grounds of Miss A. B. Jennings, Fairfield, were severely injured by the mite, *Tarsonemus pallidus* Banks. Dr. Garman visited the place on July 3 and found that many of the buds had been deformed and had turned black and some leaves were deformed.

The more important of these insects mentioned above, together with accounts of the experimental and control work of the Department are described in greater detail in the following pages of this Report.

Summer Field Meeting.

An important entomological event of the season was the summer field meeting of the entomologists of the northeastern United States, which was held in Connecticut July 26 and 27. The members gathered in New Haven on the afternoon and evening of July 25, the Hotel Taft being the headquarters. The trips to various points were made by automobile. On the morning of the 26th, they visited the Entomological Department of this Station and the Station Farm at Mount Carmel, then West Rock Park, Yale Bowl, Harkness Memorial Quadrangle, and the orchard of Frank N. Platt, Milford, where spraying and dusting experiments were being conducted. From this point the party proceeded along the coast to the State Park at Hammonasset Beach, Madison. Following the luncheon, there was a baseball game (Worthley, umpire); some of the entomologists went bathing while others collected insects along the beach. Late in the afternoon, the party went northward, passing Wesleyan University at Middletown, stopping at the large greenhouse and nursery establishment of the A. N. Pierson Co., Cromwell, viewed the gigantic elm tree in Wethersfield, and then to Hartford, where at the Hotel Bond a dinner and evening meeting had been arranged.

An interesting lecture on the Japanese beetle, illustrated by lantern slides, was given by Mr. Loren B. Smith of Riverton, N. J., in place of Mr. C. H. Hadley, who could not be present. Friday morning the party drove through Keney Park to the tobacco sub-station at Windsor, and visited the forest experimental plots at Rainbow, returning via Elizabeth Park, to Hartford, where luncheon was served in the State Capitol. After luncheon the visitors were shown about the Capitol and the State Library, then drove, via Rockville, to the Connecticut Agricultural College at Storrs. Here a demonstration of high-power spraying of woodland and orchard trees was given by the gipsy moth forces. After supper there was a baseball game between the Connecticut gipsy moth men and a team picked from the visitors (Burgess, umpire). In the evening motion pictures were shown in the armory, including those on the European corn borer, and the gipsy moth, prepared by the U. S. Department of Agriculture.

Besides members of the Station Staff, the following were present: H. A. Ames, Somerville, N. J.; E. A. Back, Washington, D. C.; D. N. Borodin, New York, N. Y.; H. L. Blaisdell, Melrose, Mass.; F. E. Brooks, Washington, D. C.; A. F. Burgess, Melrose Highlands, Mass.; C. W. Collins, Melrose Highlands, Mass.; C. R. Crosby, Ithaca, N. Y.; S. M. Dohanian, Somerville, Mass.; E. P. Felt, Albany, N. Y.; Hugh Glasgow, Geneva, N. Y.; F. W. Graves, Melrose Highlands, Mass.; Melvin Guptill, Sudbury, Mass.; T. L. Guyton, Harrisburg, Pa.; E. A. Hartley, Melrose Highlands, Mass.; G. W. Herrick, Ithaca, N. Y.; T. J. Headlee, New Brunswick, N. J.; H. E. Hodgkiss, State College, Pa.; C. E. Hood, Melrose Highlands, Mass.; J. L. Horsfall, Bustleton, Pa.; J. F. Jamieson, Riverton, N. J.; R. W. Kelley, New York, N. Y.; G. H. Lamson, Storrs, Conn.; F. H. Lathrop, Highland, N. Y.; M. D. Leonard, Albany, N. Y.; Q. S. Lowry, Boston, Mass.; J. A. Manter, Storrs, Conn.; C. W. Minott, Melrose Highlands, Mass.; F. H. Mosher, Melrose Highlands, Mass.; H. L. McIntyre, Albany, N. Y.; A. H. Parkins, Boston, Mass.; Alvah Peterson, New Brunswick, N. J.; D. M. Rogers, Boston, Mass.; J. V. Schaffner, Melrose Highlands, Mass.; A. F. Schulze, Storrs, Conn.; R. A. Sheals, Providence, R. I.; L. B. Smith, Riverton, N. J.; A. E. Stene, Kingston, R. I.; W. R. Walton, Washington, D. C.; H. I. Winchester, Melrose, Mass.; R. Woolridge, Melrose Highlands, Mass., and L. H. Worthley, Arlington, Mass.

INSPECTION OF NURSERIES IN 1923.

The General Statutes provide that "all nurseries or places where nursery stock is grown, sold, or offered for sale, shall be inspected at least once each year by the State Entomologist or one of his deputies, and if no serious pests are found, a certificate to that effect may be given." Consequently such inspection has been made each year of all growing nursery stock so far as the existence of such nursery stock is known to the State Entomologist. In 1923, two nurseries were inspected in the spring and again late in the summer. The annual inspection was commenced on July 26 and finished on September 26, except for one nursery learned about later and inspected on October 11. This work was in charge of Mr. M. P. Zappe, who was assisted by J. Leslie Rogers and T. F. Cronin. Mr. E. M. Stoddard of the Botanical Department and Doctors Garman and Britton helped one day each. For the most part these nurseries were given a rather more rigid inspection than usual, for, on account of the wide-spread infestations of the gipsy moth, it seemed almost necessary to make sure that none of the nursery stock was infested with that destructive pest. The weather was extremely favorable and as the whole period was one of protracted drought the work was not delayed on account of rain.

On the whole the nurseries were in good condition and fairly clean. Some owners are always more careful than others about such matters. Where the stock is kept clean it is not only easier to inspect, but the amount of stock to be treated or destroyed after inspection is reduced to a minimum.

At a hearing and conference before the Federal Horticultural Board at the State House, Boston, Mass., August 17, 1923, the point was made by the Board and confirmed by several of the nurserymen present that the nurseries must be kept comparatively free from serious insect and fungous pests. This idea should be reiterated and emphasized again and again. Clean stock only should be sent out from nurseries, and the customer has a right to expect it. Quarantine and inspection officers in other states are watching and may cause the destruction, treatment or return of stock found infested. Moreover, a large number of infested shipments from one state into another may lead to regulations prohibiting shipments altogether.

The understanding reached at the Boston conference is to the effect that a nurseryman must hold a state certificate before the Federal gipsy moth inspection will be granted. In the quarantined area this inspection and certification are necessary if one wishes to ship out of the infested area; but if the owner is not willing to clean up sufficiently to enable him to obtain a state certificate, the Federal inspection will be refused. Hence it behooves all nurserymen to co-operate cordially, promptly and thoroughly with the state inspectors, otherwise they may not be able to do

business because of these conditions. Several Massachusetts nurserymen stated that every tree and shrub in their nursery had been sprayed thoroughly with arsenate of lead.

However, there are pests other than the gipsy moth which must receive attention from the nurseryman. For instance the oyster-shell scale, *Lepidosaphes ulmi* Linn., is the commonest insect pest found in the nurseries, and the spruce gall aphid, *Chermes abietis* Linn., and the poplar canker, *Dothichiza populea*, are also close seconds. Both of these insects may be readily held in check by contact sprays made at the right time. The former has only one generation and the latter two generations each year in Connecticut. The spruce gall aphid attacks only spruce trees, but the oyster-shell scale infests a large number of different kinds of trees and shrubs.

Oyster-Shell Scale.

The oyster-shell scale lives through the winter in the form of white oval eggs which are formed under the shells during September. These eggs do not hatch until about the last week of the following May. The young then crawl out from underneath the old female shells and establish themselves on the bark. They soon begin to suck the sap and do not move afterwards. Each forms a shell, but these shells are very thin at first and gradually become larger and thicker. The proper time for the most effective treatment is soon after the eggs hatch and before the shells become heavy enough to protect the insects from the application. Thus a thorough spraying about the first week of June with kerosene soap emulsion, or with nicotine solution and soap will kill nearly all of the young scales. It is always advisable to cut and burn all branches or stems which can be spared and which are badly infested. The oyster-shell scale is particularly prevalent on willow, poplar, ash, birch, black walnut, butternut, lilac, maple and apple, and often occurs on many other trees and shrubs.

Spruce Gall Aphid.

The spruce gall aphid occurs only on spruce trees and two species may be found in Connecticut nurseries. The more common one, *Chermes abietis* Linn., attacks Norway, black, red and white spruces, and sometimes hemlock, making a cone-shaped swelling or gall at the base of the new growth. On the Colorado blue spruce, much larger galls occur which are caused by another species, *Chermes cooleyi* Gillette. The young females live on the twigs through the winter and in spring mature, lay their eggs and die. On hatching from the eggs in May, the young crawl to the tips of the twigs and settle at the base of the leaves where the

new growth is just beginning to form. The cone-shaped gall is here developed, the young being inside and sucking the sap. Becoming mature in August, the nymphs excape from the galls, which later turn brown and die, often killing the shoot beyond the gall. The insects molt after emerging and are then provided with wings. They crawl over the leaves where the females lay stalked eggs which hatch in about two weeks and this generation is the one which lives over winter on the twigs in a partially developed state.

On small trees in the nursery the galls may easily be clipped off in June and burned. This treatment has already been practiced in one Connecticut nursery where many conifers are grown, and resulted in few galls being found at the time of the annual inspection in August.

Spraying in April with a contact spray to kill the over-wintering females is one of the best control methods. In Massachusetts, whale oil soap, one pound in two gallons of water, proved so effective that no insects could be found afterward upon the trees. For several years in one large nursery the spruce trees have been sprayed in April with miscible oil, one part in twenty parts of water. The same treatment has also been applied late in the fall, and both spring and fall applications have been effective in controlling the spruce gall aphid. There has never been any injury to the trees from the treatment except once, and this was probably due to not mixing the contents of the original package thoroughly before diluting with water.

Poplar Canker.

From our records it appears that poplar canker was first found in Connecticut nurseries in 1918, when six nurseries were infested. Though each year infested trees have been destroyed, it has increased in abundance until in 1923 it occurred in 34 nurseries. This is an infectious disease caused by a fungus which grows in the bark in a manner similar to that of the chestnut blight, forming cankers and often girdling branches or the main trunk and killing all tissues above or beyond the point of attack. In nurseries, cutting and burning the diseased trees or branches is the remedy.

Pests Found in Nurseries.

In 32 nurseries no important pests were found. These were mostly newly established nurseries where the young stock has not become infested or small nurseries where special stock not commonly infested is grown. Following is a list of the principal pests found with the number of nurseries infested by each:

LIST OF PESTS FOUND IN NURSERIES IN 1923.

INSECTS.

Aphids, apple, green	15	Mite, European red	4
woolly	4	on box elder	1
on chestnut	1	Sawfly, *Diprion simile*	2
pine	1	on arbor-vitae	1
spiraea	1	willow	1
spruce gall,		Scale, elm	10
Chermes abietis	28	Euonymus	2
cooleyi	9	*Lecanium corni*	1
Apple and thorn skeletonizer	18	oak gall scale (*Kermes*)	1
Arbor-vitae leaf-miner	1	oyster-shell	42
Birch Bucculatrix	6	pine leaf	8
Borer, lilac	1	rose	12
peach	1	San José	20
poplar	2	scurfy	5
Curculio, poplar	1	tulip tree	4
Lace bugs	2	West Indian peach	1
Laspeyresia molesta	2	white elm	1
Lina scripta	1	Tarnished plant bug	1
		White pine weevil	17

PLANT DISEASES.

Apple scab	3	Mildew on rose	4
Blister rust	6	Mosaic, raspberry	4
Cedar rust	8	Poplar canker	34
Crown gall	3		
Fire blight	3	Uninfested	32

From the preceding list it may be seen that the oyster-shell scale is found in a larger number of nurseries (42) than any other pest on the list, though the poplar canker comes next, being found in 34 nurseries.

In order to show how the figures of 1923 compare with those of preceding years, the following table shows the comparative abundance of the principal nursery pests for the past six years:

SIX YEAR RECORD OF SERIOUS AND COMMON NURSERY PESTS.

Pest	1918	1919	1920	1921	1922	1923
Oyster-shell scale	39	38	38	36	44	42
San José scale	18	19	11	28	19	20
Spruce gall aphid	15	19	21	31	21	28
White pine weevil	5	5	1	1	19	17
Apple and thorn skeletonizer	..	..	..	..	1	18
Poplar canker	6	5	13	21	31	34
Blister rust	1	..	..	2	9	6
No pests	32	32	46	36	36	32

One nursery has gone out of business since last year, three have changed ownership, and fourteen new names appear on the list. One nursery has been inspected twice. The list contains five more names than the list for 1922. Six other nurseries were

inspected but have not reported that the infestations have been removed. These have no certificates and will violate the law every time they make a sale.

In addition to the inspection of the nurseries, 60 separate packages of nursery stock have been inspected to accommodate individuals who wish to ship, and in some cases inspection of parcels has been made and certificates issued to nurseries which have not received the regular form of certificate covering their nursery stock.

The nurserymen's list for 1923 contains 106 names, as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1923.

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Barnes Bros. Nursery Co.	Yalesville	150	Sept. 25	1421
Barnes Nursery & Orchard Co.	Wallingford	45	Oct. 8	1437
Barton Nursery	Hamden	1	Sept. 21	1411
Beattie, Wm. H.	New Haven	1	Sept. 21	1412
Benbow, A.	Norfolk	1	Oct. 1	1430
Bertolf Brothers	Greenwich	25	Sept. 18	1402
Brainard Nursery & Seed Co.	Thompsonville	10	Sept. 27	1424
Braley & Co.	Burnside	1	Sept. 11	1390
Bretschneider, A.	Danielson	1	Sept. 18	1404
Bristol Nurseries, Inc.	Bristol	16	Oct. 15	1439
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 1	1363
Burroughs, Thos. E.	Deep River	3	Sept. 14	1396
Chapman, C. B.	Groton	1	Sept. 24	1419
Chapman, C. E.	North Stonington	2	Sept. 27	1427
Clinton Nurseries (Warren Richards, Mgr.)	Clinton	1	Oct. 31	1452
Conine Nursery Co.	Stratford	50	Sept. 8	1387
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Nov. 17	1460
Conn. Agr. Exp. Sta. (W. O. Filley, Forester)	New Haven	1	Sept. 18	1401
Crofut & Knapp Farm	Norwalk	20	Nov. 23	1462
Cross Highway Nurseries	Westport	6	Nov. 28	1464
Crouch, Alden	Mystic	1	Apr. 7	1361
Dallas, Inc., Alexander	Waterbury	1	Sept. 22	1414
Dawson's Nursery	Willimantic	2	Aug. 24	1369
Dowd, F. C.	Madison	1	Sept. 7	1386
Dunlap, Daniel S.	Cromwell	1	Aug. 30	1378
Edgewood Nursery, Vidal, Inc.	Stamford	5	Sept. 14	1398
Eldredge, Charles F. (2)	Niantic	1	Sept. 24	1417
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont and New Haven	155	Aug. 27	1373
Evergreen Nursery Co.	Wilton	5	Sept. 7	1384
Fairty, C. H.	New Canaan	1	Dec. 7	1466
Falcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Oct. 6	1436
Fraser, G. W.	Willimantic	1	Aug. 24	1370
Gardner's Nurseries	Rocky Hill	5	Nov. 13	1459
Geduldig's Greenhouses	Norwich	1	Sept. 14	1397

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	6	Nov. 30	1465
Heath & Co	Manchester	5	Aug. 1	1365
Hilliard, H. J.	Sound View	1	Sept. 24	1418
Hiti Nurseries (J. H. Bowditch, Prop)	Pomfret Center	9	Aug. 30	1374
Holcomb, Irving	Simsbury	1	Aug. 30	1379
Hoogendoorn, C.	Yalesville	1	Sept. 6	1383
Horan & Son, Jas.	Bridgeport	1	Oct. 15	1440
Houstons' Nurseries	Mansfield	4	Nov. 3	1455
Hoyt's Sons Co., Inc., The Stephen	New Canaan	300	Sept. 20	1406
Hunt & Co., W. W.	Hartford	10	Sept. 26	1423
Isselee, Charles	Darien	10	Nov. 24	1463
Jones, William	Norwalk	1	Aug. 30	1375
Kelly, James J.	New Canaan	1	Sept. 13	1394
Kellner, Herman H.	Danbury	1	Sept. 27	1425
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 10	1388
Ladd & Nichols	Greenwich	2	Sept. 24	1415
Laddin's Rock Nursery (Est. of W. L. Marks)	Stamford	5	Aug. 24	1372
Langenbach, F. J.	Norwich	1	Aug. 24	1368
Leghorn, John J.	Cromwell	1	Aug. 30	1376
Mallett Co., George A.	Bridgeport	1	Oct. 15	1441
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	1	Nov. 9	1457
Marigold Farm (H. Kelley, Prop.)	New Canaan	6	Nov. 21	1461
Meier, A. R.	West Hartford	1	Oct. 19	1446
Millane Tree Expert Co., The	Middletown	1	Nov. 12	1458
Myers, C. B.	Milford and Rowayton	6	Oct. 15	1443
New Haven Nurseries Co., The	New Haven	10	Sept. 15	1399
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Aug. 24	1371
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Oct. 29	1447
New London County Nurseries (W. J. Schoonman, Prop.)	New London	5	Oct. 15	1442
North-Eastern Forestry Co.	Cheshire	20	Aug. 20	1367
Oakland Nurseries	Manchester	5	Aug. 1	1364
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	25	Sept. 12	1393
Ouwerkerk & Van der Stam	Yalesville	7	Sept. 6	1380
Park Gardens	Bridgeport	1	Sept. 20	1407
Park Hill Flower Shop	Manchester	1	Sept. 12	1392
Pequod Nursery Co.	Yalesville	15	Sept. 11	1389
Phelps, J. Wesson	Bolton	1	Oct. 29	1448
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Oct. 29	1449
Pierson, A. N., Inc.	Cromwell	50	Aug. 30	1377
Polish Orphanage Farm (Rev. L. Bojnowski, Mgr.)	New Britain	1	Sept. 25	1420
Pomeroy, Edwin C.	Northville	1	Sept. 27	1426
Reck, Julius	Bridgeport	1	Oct. 31	1450
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	4	Aug. 1	1366
Ryther, O. E.	Norwich	6	Oct. 3	1434
Saxe & Floto	Waterbury	1	Sept. 18	1405
Scheepers, Inc., John	Sound Beach	6	Sept. 18	1403
Schleichert, J. L.	Bridgeport	1	Sept. 20	1408

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Scott, J. W.	Hartford	5	Nov. 6	1456
Seely, C. H.	Darien	1	Oct. 1	1431
Sierman, C. H.	Hartford	5	Oct. 10	1438
South Wilton Nurseries	South Wilton	5	Sept. 7	1385
Stamford Seed & Flower Co.	Stamford	1	Oct. 1	1432
Steck, Charles A.	Newtown	3	Oct. 2	1433
Steck, Jr., Charles A.	Bethel	1	Oct. 31	1454
Steck, Mrs. Chas.	Bethel	1	Oct. 31	1453
Stratfield Nursery Co.	Bridgeport	6	Dec. 17	1467
Stratford Nursery Co. (C. A. Cooper, Prop.)	Stratford	1	Sept. 20	1410
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	3	Sept. 20	1409
Tanner's Nursery Co.	Manchester	1	Oct. 16	1445
Upson, R. E.	Marion	1	Sept. 25	1422
Vanderbrook & Son, Chas. L.	Manchester	5	Sept. 11	1391
Van Wilgen & Co	Branford	15	Sept. 6	1381
Verkade's Nurseries	New London	8	Sept. 24	1416
Vidbourne & Co., J.	Hartford	7	Sept. 28	1429
Wallace Nursery	Wallingford	2	Sept. 6	1382
Watrous, Arthur J.	Meriden	1	Sept. 18	1400
Wild, Henry	Greenwich and Norwalk	16	Oct. 6	1435
Wilson & Co., C. E.	Manchester	50	Sept. 14	1395
Woodruff, C. V.	Orange	1	Sept. 21	1413
Yale University Forest School	New Haven	1	Sept. 28	1428
Young, Mrs. Nellie A.	Pine Orchard	1	Oct. 31	1451
Zack Co., H. J.	Deep River	2	Oct. 16	1444
Total acreage		1,731		

INSPECTION OF IMPORTED NURSERY STOCK.

The nursery stock entering Connecticut from foreign countries during 1923 consisted of 35 shipments, 179 cases, and 1,981,895 plants. This is a larger number of shipments and cases than last year, but a smaller number of plants. The following table shows the quantities of such nursery stock inspected at destination by State inspectors during the last four years:

Year	No. of Shipments	No. of Cases	No. of Plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595
1923	35	179	1,981,895

This stock consists of Manetti rose stock and fruit seedlings to be used for propagation,—budding and grafting. More than one-half, mostly rose stock, was consigned to one firm. The inspections were nearly all made by Mr. Zappe.

The time required to inspect this stock amounts to 264 hours, or 1.35 months of 26 working days of seven and one-half hours

each. The total cost of this work including time of men and traveling expenses amounted to $289.11.

The sources of this imported nursery stock for the year were as follows:

SOURCES OF IMPORTED NURSERY STOCK, 1922-1923.

Country	No. of Shipments	No. of Cases	No. of Plants
France	14	74	1,009,700
Holland	14	79	720,195
England	5	21	212,000
Italy	1	2	13,000
Unknown	1	3	27,000
	35	179	1,981,895

The following table shows the quantities of stock as inspected by months:

Month	No. of Shipments	No. of Cases	No. of Plants
November	2	5	58,240
December	4	25	251,500
January	13	69	796,000
February	8	40	459,555
March	7	29	312,600
April	1	11	104,000
	35	179	1,981,895

In addition to the stock inspected and reported above, there were eight shipments containing 40 cases and 415,800 plants which were reshipped to other states and not inspected in Connecticut.

There were nine shipments consisting of 16 cases of seeds which entered Connecticut but were not inspected here. One shipment of one case containing 5,000 apple seedlings was received which had already been inspected in New York, and consequently it was not reinspected.

Of the 35 shipments inspected, 15 or 42.8 per cent. were found infested with insects or other animals or plant diseases, some of which are well-known pests. For instance, if *Aporia crataegi* Linn. should become established in the United States, it would add another to the already large list of pests which feed upon the foliage of fruit trees and rosaceous plants. Details of these infested shipments are given below.

PESTS FOUND ON IMPORTED NURSERY STOCK.

15 Shipments Infested.

INSECTS.

Aporia crataegi Linn. on fruit seedlings. (1 shipment) A. Choplin, Maze, France.

Emphytus cinctus Linn. (13 shipments) Fa. As. Ouwerkerk, Boskoop, Holland; W. Fromow & Sons, Windlesham, Surrey, England; M. Gielen, Oudenbosch, Holland; B. Rugo, Ltd., Dedemsvaart, Holland; W. C.

Slocock, Woking, Surrey, England; P. L. Renault, Orleans, France; Hemeray-Aubert, Orleans, France; D. G. de Jonge, Sappemeer, Holland; Felix & Dykhuis, Boskoop, Holland; S. Bide & Sons, Ltd., Farnham, Surrey, England; N. Levasseur & Fils, Ussy, France.

Lepidopterous cocoons. (2 shipments) P. L. Renault, Orleans, France; N. Levasseur & Fils, Ussy, France.

Spider's eggs. (1 shipment) P. L. Renault, Orleans, France.

PLANT DISEASES.

Crown Gall on Manetti rose. (6 shipments) W. Fromow & Sons, Windlesham, Surrey, England; R. C. Noteult, Woodbridge, England; W. C. Slocock, Woking, Surrey, England; Hemeray-Aubert, Orleans, France; S. Bide & Sons, Ltd., Farnham, Surrey, England.

INSPECTION OF APIARIES.

As in preceding years, the work of inspecting apiaries has been done on a *per diem* basis by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford. Mr. Coley covers the southern half of the State, Fairfield, New Haven, Middlesex and New London Counties. Mr. Yates covers the northern half, Litchfield, Hartford, Tolland and Windham Counties.

This work required a total of 131 man days, and the entire cost for the season was $1,849.80.

Fewer apiaries were inspected in 1923 than in each of the three years preceding. This was due, in part at least, to the fear that bees would take to "robbing" if disturbed, on account of the extreme lack of moisture.

The following figures show the number of apiaries and colonies inspected, and the average number of colonies per apiary for the past three seasons:

Year	No. Apiaries	No. Colonies	Average No. Colonies per Apiary
1921	751	6,972	9.2
1922	797	8,007	10.04
1923	725	6,802	9.38

In 1923, inspections were made in 119 towns as against 125 towns in 1922. No apiaries have ever been inspected in the town of Union, Tolland County, because the inspector has never been able to learn of bees being kept in that town.

In 1923, inspections were made in the following 22 towns not visited in 1922: *Fairfield County:* Danbury, Stratford and Trumbull; *New Haven County:* Derby, Meriden and Orange; *Middlesex County:* Cromwell, East Haddam, East Hampton, Haddam, Middlefield and Middletown; *New London County:* None; *Litchfield County:* Bethlehem, Harwinton, New Hartford, Watertown and Woodbury; *Hartford County:* Farmington and Rocky Hill; *Tolland County:* None; *Windham County:* Chaplin, Eastford and Putnam.

On the other hand, in 1922 inspections were made in the following 29 towns not visited in 1923: *Fairfield County:* Bridgeport, Newtown and Weston; *New Haven County:* Bethany, East Haven, Middlebury, New Haven, Oxford and Woodbridge; *Middlesex County:* Westbrook; *New London County:* Colchester, Lyme and North Stonington; *Litchfield County:* Bridgewater, Canaan, Cornwall, Kent, New Milford, Norfolk, North Canaan, Salisbury and Sharon; *Hartford County:* Avon and Hartford; *Tolland County:* Tolland and Willington; *Windham County:* Ashford, Brooklyn and Scotland.

European Foul Brood.

Out of the 725 apiaries and 6,802 colonies inspected in 1923, 17 apiaries and 25 colonies were found infested with European foul brood. This gives a ratio of 2.34 per cent. of apiaries and .36 per cent. of colonies infested, as against 4.14 and .85 per cent. respectively in 1922.

European foul brood has gradually decreased in Connecticut since the inspection was begun in 1909. In 1923 this disease was not found at all in Fairfield, New Haven and Tolland Counties. European foul brood was found in the following towns in 1923: *Middlesex County:* Durham and East Hampton; *New London County:* Norwich, Old Lyme and Stonington; *Litchfield County:* Winchester; *Hartford County:* Glastonbury and Suffield; *Windham County:* Killingly, Plainfield, Pomfret, Putnam and Sterling.

Last year 33 apiaries and 68 colonies were found infested with European foul brood. Compared with these figures, the infestations in 17 apiaries and 25 colonies in 1923 are quite encouraging.

American Foul Brood.

Of the 725 apiaries and 6,802 colonies inspected in 1923, seven apiaries and 22 colonies were infested with American foul brood. This is a ratio of .965 per cent. of apiaries and .323 per cent. of colonies as against 1.38 and .27 per cent. respectively in 1922. American foul brood was not found in Connecticut until 1914. Since then there has never been much of this disease, but the percentage is spasmodic and erratic. It fluctuates irregularly and has shown no such gradual change as has been the case with the decrease in the European foul brood.

In 1923, this disease occurred in the following seven towns: *Fairfield County:* Greenwich and Trumbull; *New Haven County:* Derby, Seymour and Wallingford; *Middlesex County:* East Hampton; *Windham County:* Killingly.

The statistics of the apiaries inspected in each of the 119 towns visited, arranged by counties, are given on the following pages, and summarized on page 252.

APIARIES INSPECTED IN 1923.

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Fairfield County:							
Bethel	5	0	22	0	0	0	0
Danbury	1	0	15	0	0	0	0
Darien	1	0	16	0	0	0	0
Easton	6	0	120	0	0	0	0
Fairfield	9	1	83	2	0	0	2
Greenwich	7	4	27	7	6	0	1
Monroe	4	0	77	0	0	0	0
New Canaan	2	0	29	0	0	0	0
Norwalk	5	0	63	0	0	0	0
Redding	7	0	29	0	0	0	0
Shelton	2	0	34	0	0	0	0
Stamford	7	0	162	0	0	0	0
Stratford	6	0	37	0	0	0	0
Trumbull	8	1	100	2	2	0	0
Westport	6	0	56	0	0	0	0
Wilton	5	1	75	1	0	0	1
	81	7	945	12	8	0	4
New Haven County:							
Beacon Falls	2	0	38	0	0	0	0
Branford	2	0	10	0	0	0	0
Cheshire	3	0	47	0	0	0	0
Derby	4	1	33	6	6	0	0
Guilford	2	0	34	0	0	0	0
Hamden	5	0	57	0	0	0	0
Madison	2	0	24	0	0	0	0
Meriden	14	0	99	0	0	0	0
Milford	6	0	78	0	0	0	0
Naugatuck	7	0	52	0	0	0	0
North Haven	7	0	87	0	0	0	0
Orange	5	0	33	0	0	0	0
Prospect	5	0	79	0	0	0	0
Seymour	2	1	33	2	2	0	0
Wallingford	26	2	154	3	1	0	2
Waterbury	10	0	115	0	0	0	0
West Haven	1	0	7	0	0	0	0
	103	4	980	11	9	0	2
Middlesex County:							
Chester	7	0	44	0	0	0	0
Clinton	2	0	17	0	0	0	0
Cromwell	1	0	3	0	0	0	0
Durham	9	2	147	4	0	4	0
East Haddam	11	0	226	0	0	0	0
East Hampton	10	3	100	4	2	2	0
Essex	2	0	29	0	0	0	0
Haddam	8	0	74	0	0	0	0
Killingworth	2	0	11	0	0	0	0

APIARIES INSPECTED IN 1923—*Continued.*

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Middlesex County—*Con.*							
Middlefield	5	0	56	0	0	0	0
Middletown	1	0	1	0	0	0	0
Old Saybrook	3	0	58	0	0	0	0
Saybrook	5	0	24	0	0	0	0
	66	5	790	8	2	6	0
New London County:							
Bozrah	2	0	17	0	0	0	0
East Lyme	3	0	47	0	0	0	0
Franklin	3	0	35	0	0	0	0
Groton	3	0	23	0	0	0	0
Lebanon	4	0	44	0	0	0	0
Montville	3	0	36	0	0	0	0
New London	2	0	24	0	0	0	0
Norwich	7	1	566	1	0	1	0
Old Lyme	2	1	45	2	0	2	0
Preston	9	0	66	0	0	0	0
Stonington	4	1	23	1	0	1	0
Waterford	3	0	20	0	0	0	0
	45	3	946	4	0	4	0
Litchfield County:							
Barkhamsted	1	0	18	0	0	0	0
Bethlehem	1	0	8	0	0	0	0
Colebrook	2	0	9	0	0	0	0
Goshen	4	0	16	0	0	0	0
Harwinton	1	0	3	0	0	0	0
Litchfield	20	1*	175	1*	0	0	0
Morris	7	0	45	0	0	0	0
New Hartford	1	0	5	0	0	0	0
Plymouth	6	0	17	0	0	0	0
Thomaston	10	0	76	0	0	0	0
Torrington	6	0	54	0	0	0	0
Washington	2	1*	76	1*	0	0	0
Watertown	18	0	92	0	0	0	0
Winchester	10	2*	61	6*	0	5	0
Woodbury	5	1*	50	1*	0	0	0
	94	5*	705	9†	0	5	0
Hartford County:							
Berlin	17	0	199	0	0	0	0
Bloomfield	5	0	54	0	0	0	0
Bristol	15	0	74	0	0	0	0
Burlington	2	0	13	0	0	0	0
Canton	9	0	68	0	0	0	0
East Granby	6	0	32	0	0	0	0

* 1 colony with Paralysis.
† 4 colonies with Paralysis.

APIARIES INSPECTED IN 1923—*Continued.*

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Hartford County—*Con.*							
East Hartford	3	0	18	0	0	0	0
East Windsor	8	0	81	0	0	0	0
Enfield	6	0	38	0	0	0	0
Farmington	18	0	68	0	0	0	0
Glastonbury	19	1	144	1	0	1	0
Granby	8	0	87	0	0	0	0
Manchester	11	0	71	0	0	0	0
New Britain	8	0	118	0	0	0	0
Newington	6	0	74	0	0	0	0
Plainville	3	0	7	0	0	0	0
Rocky Hill	4	0	25	0	0	0	0
Simsbury	4	0	45	0	0	0	0
Southington	8	0	40	0	0	0	0
South Windsor	7	0	32	0	0	0	0
Suffield	12	1*	93	3*	0	1	0
West Hartford	15	0	74	0	0	0	0
Wethersfield	2	0	10	0	0	0	0
Windsor	1	0	9	0	0	0	0
Windsor Locks	2	0	11	0	0	0	0
	199	2*	1,485	4*	0	2	0
Tolland County:							
Andover	6	0	36	0	0	0	0
Bolton	6	0	15	0	0	0	0
Columbia	3	0	7	0	0	0	0
Coventry	13	0	61	0	0	0	0
Ellington	4	0	14	0	0	0	0
Hebron	4	0	26	0	0	0	0
Mansfield	3	0	28	0	0	0	0
Somers	3	0	14	0	0	0	0
Vernon	1	0	13	0	0	0	0
	42	0	214	0	0	0	0
Windham County:							
Brooklyn	2	0	176	0	0	0	0
Canterbury	2	0	18	0	0	0	0
Chaplin	1	0	3	0	0	0	0
Eastford	6	0	18	0	0	0	0
Hampton	11	0	60	0	0	0	0
Killingly	13	2	46	4	3	1	0
Plainfield	20	1	111	1	0	1	0
Pomfret	12	1	88	2	0	2	0
Putnam	5	1	32	1	0	1	0
Sterling	2	2	8	3	0	3	0
Windham	7	0	67	0	0	0	0
Woodstock	14	0	110	0	0	0	0
	95	7	737	11	3	8	0

* 2 colonies with Paralysis.

SUMMARY.

County	No. of Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Paralysis	Sacbrood
Fairfield	16	81	7	945	12	8	0	0	4
New Haven	17	103	4	980	11	9	0	0	2
Middlesex	13	66	5	790	8	2	6	0	0
New London	12	45	3	946	4	0	4	0	0
Litchfield	15	94	5	705	9	0	5	4	0
Hartford	25	199	2	1,485	4	0	2	2	0
Tolland	9	42	0	214	0	0	0	0	0
Windham	12	95	7	737	11	3	8	0	0
	119	725	33	6,802	59	22	25	6	6

	No. Apiaries	No. Colonies
Inspected	725	6,802
Infested with European foul brood	17	25
Per cent. infested	2.34	.36
Infested with American foul brood	7	22
Per cent. infested	.965	.323
Sacbrood	4	6
Bee paralysis	5	6
Average number of colonies per apiary		9.38
Cost of Inspection		$1,849.80
Average cost per apiary		$2.55
Average cost per colony		.27

REGISTRATION OF BEES.*

Many beekeepers are not complying with the law in regard to the annual registration of bees. They seem to think that if they register once, they need not do so again, but the law requires them to register each year before October 1st. This law is Chapter 174 of the Public Acts of 1919, and reads as follows:

"Section 1. Every person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the town clerk of the town in which such bees are kept, for the registration of such bees, and such town clerk shall issue to such applicant a certificate of registration upon the payment of a recording fee of twenty-five cents, which certificate shall be in the form prescribed and upon blanks furnished by the commissioner of domestic animals and shall be recorded in the office of such town clerk.

Sec. 2. A record of such registration with the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be recorded in a separate book in the office of the town clerk, which records shall be accessible to the public.

Sec. 3. Any owner of bees who shall fail to register as required by the provisions of this act shall be fined not more than five dollars."

*Published as Bulletin of Immediate Information No. 27, September 15, 1923, and sent to the newspapers, all town clerks, and to all beekeepers where inspections have been made during the past four years.

An amendment to this law was passed at the last session of the General Assembly (see Chapter 129, Public Acts of 1923) as follows:

"Section two of chapter 174 of the public acts of 1919 is amended to read as follows: A record of such registration and of the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be kept in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall file with the state entomologist of the Connecticut Agricultural Experiment Station a complete list of such registrations and locations on or before the first day of February of the year succeeding such registrations. Any town clerk failing to perform such duty shall be fined not more than ten dollars."

Therefore in order to comply with the Statutes, each beekeeper should register his bees each year before October 1st, with his town clerk, and each town clerk must send to the State Entomologist before February 1st, a list of the beekeepers who have registered in that town.

REPORT OF GIPSY MOTH WORK.

Year ending June 30, 1923.

By John T. Ashworth and W. E. Britton.

This work has been conducted in about the same manner as in former seasons and the methods were described in considerable detail in the Report of this Station for 1922, pages 290-326. The satisfactory co-operation between the State and Federal forces has continued, the Federal men for the most part working along the outside border of the infested area with a view of expending a major portion of the Federal appropriation in preventing the further spread of the pest. The present writers hereby express to Messrs. A. F. Burgess, in charge of moth work, and Harry E. Blaisdell, in charge of scouting and extermination work, their cordial appreciation of the aid received from Federal sources.

During most of the season 30 men have been employed by the State on gipsy moth work. Except for the wind-spread of a few years ago, which greatly increased the area infested and rendered the fixed appropriation inadequate to cover the territory, the pest has been kept well in check. There has never been any stripping of trees or noticeable injury in Connecticut caused by the gipsy moth.

Details of the season's work will be found in the following pages.

New Equipment.

Two new Ford light trucks have been purchased during the year and are used to transport scouting crews back and forth between the field and the boarding and lodging places. One Ford touring car was replaced by a new one in September, 1922.

Windham County.

This County, situated in the northeastern corner of the State and bordered as it is by Massachusetts on the north and by Rhode Island on the east, was the first part of the State to become generally infested, and is now as in former years the most heavily infested portion of the State, although no stripping has ever been found in Connecticut up to this time. The work of the past year in Windham County was all done by the State forces except in the towns of Thompson, Putnam and Pomfret; these towns were used as schools to teach and break in new men for the Federal Govern-

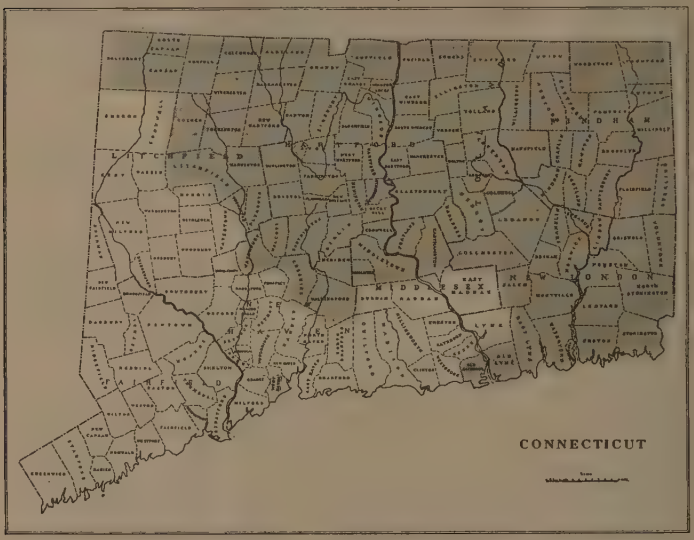

Figure 9. Map of Connecticut showing territory quarantined in 1923 on account of gipsy moth

ment, our own foreman being in charge but on the Federal pay roll. The table of statistics on page 262 shows the degree of infestation in each town.

In the towns of Canterbury, Chaplin, Hampton, Plainfield and Sterling, the infestations were all small and not worthy of particular mention.

In Ashford, one colony of 107 egg-clusters was found in woodland on the western side of Biglow brook on land owned by G. H. Myers of Union, Connecticut.

Brooklyn had one colony which was considered dangerous, 47 egg-clusters being found on an oak tree in an open pasture owned

by Patrick Moran near the junction of the State road and the Allen Hill road.

In Eastford two large colonies were found, both woodland infestations, one of 191 egg-clusters just south of Crystal Lake on land owned by Andrew Chilkott, and the other on land owned by Mr. Floating about two miles west of Eastford Post Office on the eastern edge of Nachaug River, containing 249 egg-clusters.

Killingly was not entirely scouted as the egg-masses were hatching before the work could be completed. One colony of 40 egg-clusters was found in a pasture orchard owned by C. W. Williams and situated along the Quinebaug River near what is known as the Ox-bow.

Pomfret as stated above was used as a school to train men, and the scouting was not completed; all colonies found were small.

In the town of Putnam the conditions were similar to those in Pomfret.

The worst colony in Scotland, though one easily handled, was found in an orchard owned by Mr. B. Ashley on the road leading off the State road just west of where Merrick brook crosses the State road; 26 egg-masses were found here.

Sterling was scouted the last of the season, and all infestations found were small and not considered dangerous.

Scouting in Thompson was not completed on account of lack of time, men, and money. Most of the work was confined to the western half of the town, and conditions were found to be about the same as last year. One colony of 135 egg-clusters was discovered in an old orchard owned by D. H. Cortiss just north of his home. The other infestations were small and easily handled.

Windham had two large colonies, both of which were found in orchards owned by Mr. W. A. Standish in North Windham, one of 31 egg-clusters in cherry trees and one of 84 egg-clusters in apple trees. Both of these colonies were very easy to spray and watch.

New London County.

With the exceptions of the towns of Lyme, Old Lyme and East Lyme, all work in New London County was done by State crews this year. The above named towns were scouted by Federal men.

In Bozrah one old egg-cluster was found near the Norwich town line on Wawecus Hill.

Colchester was scouted only in the eastern half, one colony of five egg-clusters being found on land owned by Barnet Rabenowitz, situated south of the Norwich-Colchester State road, near the Lebanon town line.

There were two groups of colonies found in East Lyme. One group contained two infestations situated in the northeastern part of the town near the Montville line: one of these had 10 egg-

clusters and was on land owned by Peter Trasco. The other group was in Niantic in the southern end of the town along the coast line; two colonies in this group were considered dangerous, one of 15 egg-clusters on land owned by F. E. Temple and one of 13 egg-clusters on land owned by H. B. Morton, both being found on apple trees in the Niantic section of the town. Forty trees were banded in the spring by Federal men.

In the town of Griswold two bad colonies were found, both in the vicinity of Hopeville and both on apple trees, one of 44 egg-clusters on land owned by William Lord, and one of 20 on land owned by Mr. York.

In scouting Groton this year, the town was found practically free from the gipsy moth, except in the villages of West Mystic and Groton where a number of infestations of one and two egg-clusters were found. One colony of 37 egg-masses was found on apple trees owned by E. D. Bengemor and C. R. Heath in the northern part of West Mystic.

One colony of 20 egg-clusters was found in Lebanon. This colony was in a large oak, on land owned by Mr. Sam Lubetsky in the western end of the town about one mile south of Brewster pond.

All of the colonies in Ledyard were small, an infestation of six egg-clusters being the largest.

Lisbon had one colony of eight egg-clusters on two white oaks in the southern end of the town between the railroad and Quinebaug River, on land owned by James McCanne.

None of the infestations found in New London were large or dangerous, one of five egg-clusters being the largest; this colony was found on three maples at Mrs. Gutri's home on the lower boulevard.

The infestations in Norwich were all in the southeastern part of the town, with the exception of one of five egg-clusters found on apple trees on property owned by Joe Lamoth in Taftville; the only colony that was of any size was in two apple trees in the yard of Philip Werster in the western part of the city section, 17 egg-clusters being found.

The usual roadside scouting was not done in North Stonington this season, but some woodland work was done early in the fall; one colony of 17 egg-clusters was found in woodland near the Westerly town line in the southeastern corner of the town.

Old Lyme had three colonies, two of them being large for this territory. One was found on the north side of the State road near Rogers Lake in some pasture oaks owned by Ernest Rogers, where 16 egg-clusters were found; the other was a colony of 12 egg-clusters in apple trees around a house owned by Walter H. Hanems, situated in the Black Hall district. Sixty-one trees were banded and spraying was done at all of the infestations by Federal men.

On account of the lateness of the season the scouting in Preston had to be done in a hurried manner and one colony of 35 egg-clusters was found in woodland owned by S. F. Pierce, situated in the eastern part of the town along the west branch of Broad Brook; the other infestations were all small.

Salem was scouted but no trace of the gipsy moth found.

In Sprague, all three of the infestations were in the northeastern part of the town near Hanover. One of 17 egg-clusters was found in a roadside orchard owned by William Westburg; another of five egg-clusters in a roadside white oak owned by Nicholas Kaletchi. Both of these colonies were sprayed. The other infestation was small, two old egg-clusters being found there.

Stonington was found to be generally but not heavily infested. Two of the largest colonies are herein mentioned: one of 71 egg-clusters found on a large oak in a pasture owned by Silas Wheeler in Old Mystic; the other was in an old orchard in the Wequetequock section where 27 egg-masses were found.

In Voluntown, the infestations were all small, the largest being one of 15 egg-clusters on two apple trees located near the Sterling line, owned by William Jarvis. One of 12 egg-clusters in an apple orchard near the center of the town might be mentioned, but the rest were all very small.

Three infestations were found in Waterford; all were small, three egg-clusters being the largest.

Lyme was scouted but nothing was found.

Tolland County.

All work in Tolland County this year was done by State crews. The towns along the northern edge of the county, on the Massachusetts border, were the most heavily infested; the rest of the county being comparatively free from this pest, some of the towns having only a single infestation.

Two colonies were found in the northern part of Andover, one of nine egg-clusters in white oaks owned by George Terstin and D. Keefe; the other of 12 egg-clusters was in apple trees owned by A. E. Samuels.

One colony and a single egg-mass were found in Bolton. Both were in apple trees. At the colony 16 egg-clusters were found in an orchard owned by B. Andsaldi near the Hebron town line.

Two small colonies and a single egg-cluster were found in Columbia; all were near together in the southwestern corner of the town near the Hebron town line. These colonies contained three and four egg-clusters respectively and were found in apple trees owned by Mr. C. L. Robinson and J. Kemvitz.

The scouting in Ellington had to be stopped on account of deep snow, but later in the season the work was taken up and the town finished; in fact all the crews in this district were moved at this

time to the southern part of the State around New London. Three of the largest colonies are herein mentioned. One of 79 egg-clusters was found in an orchard owned by Frank Gotcha about one mile south of Soapstone mountain; another of 46 egg-clusters was in apple and oak trees owned by Charles Thompson in the northwestern corner of the town. The third was one of 36 egg-clusters found in an oak owned by Clarence Clark near the Ellington railroad station.

Nothing was found in Hebron, but while scouting the town, some of the men got over the line into the northeastern corner of Marlborough and found three old egg-clusters in a white oak on land owned by Joseph Soglio; it was a question whether they were in Hebron or Marlborough, but the foreman charged them up to Hebron.

Somers was found to have infestations distributed over the entire town, none of which were very large. Two of 36 egg-clusters each were the largest. One of these colonies was in an orchard owned by Mr. Miller just west of Bald Hill; the other was found in two white oaks in a field in the village of North Somers. Another colony of 37 egg-clusters was found in a white oak owned by M. Keeney in the southwestern part of the town. These three and a number of smaller infestations were sprayed in the spring.

By looking at the table of statistics any one would think that Stafford (with its 142 infestations) was literally covered with gipsy moths, but such is not the case; the town is generally infested but not so badly as it seems. Single egg-clusters were called infestations in this town, and as there are a great many of them, it makes the degree of infestation look more serious than it really is. The largest colony contained 170 egg-clusters in apple trees and one maple tree owned by John Kellog located about one and one-half miles south of State Line pond. This was easily handled. Another large colony of 63 egg-clusters was found in a white oak in a woodland margin about one mile southwest of the West Stafford Post Office. Though the above mentioned colonies were the largest ones found, there were four other of 40 egg-clusters and several smaller ones which were all sprayed by State men in the spring.

Three small colonies were found in Tolland in addition to a number of single egg-cluster infestations. Fifteen egg-clusters were found in an orchard owned by Mike Barezczski, and another of 21 egg-clusters in five oaks owned by John E. Clough, both of which were situated a little north of Tolland village. The third colony was one of 21 egg-clusters in one apple tree and a stone wall on land owned by Charles Wockomocker, about one mile west of the South Willington railroad station.

In Union two large colonies were found in the extreme northwestern corner of the town, both in apple trees, one of 41 egg-clusters on land owned by Myron Heck, the other of 77 egg-

clusters on the property of A. B. Wells. The largest colony found in the town was on the north shore of Mashapaug Lake on land owned by Dwight L. Crawford, 80 egg-clusters being found. The other 23 infestations in the town were small, containing from five to eight egg-clusters each.

Ninety-five of the 129 egg-clusters found in Vernon this season were on one apple tree owned by Peter Swanick in Rockville. The rest of the infestations were all small and in the Rockville section of the town.

The towns of Willington and Mansfield were not scouted this year on account of shortage of men and lack of time.

Hartford County.

Part of the work in Hartford County was done by Federal men and part by State men. Some of the towns which were scouted last year were not covered this year on account of a shortage of trained men and money, as the towns along the Massachusetts border further west had to be given attention.

Berlin was scouted by Federal men and three infestations found, all of them in the southern part of the town. One infestation of six egg-clusters was found on a walnut tree owned by James Derby; another of three egg-clusters in an oak and apple tree owned by the Connecticut Orchard Company, and the third of seven egg-clusters in apple trees owned by John T. Molumphy.

Federal men also did the work in Bloomfield, where five infestations were found, two of which were large colonies; one containing 40 egg-clusters was found on a large oak on land owned by J. S. Lagan, and the other of 15 egg-clusters was in an orchard owned by W. J. Cooley. All five of the infestations were in the southern end of the town along the Hartford and West Hartford borders. Twenty-three trees were banded and later 40 trees sprayed by Federal men.

All work in Bristol was done by Federal men and two small colonies found. One colony of 20 egg-clusters was found in the extreme northeastern corner of the town on apple trees owned by William Harding, and the other colony was one of eight egg-clusters in an orchard owned by M. Levinska, located about half way between Bridge pond and the Bristol reservoir. Ten trees were banded and 50 sprayed in the spring.

The work in Enfield was done by State men, nine infestations being found, of which two were large for this section of the State; one contained 29 and the other 15 egg-clusters. Both of these colonies were found in apple trees owned by George Hardiman and Eugene Quinn, and both were in the Thompsonville district; the other infestations were all small.

State men did the work in East Windsor, where most of the infestations were small. Two, however, were very bad. One of

109 egg-clusters was found in five apple trees in a dooryard on the Simon Miskill Estate at Broadbrook, and the other in a white oak at Warehouse Point owned by William Trombley, where 163 egg-clusters were found.

Newington was scouted by Federal men and two infestations found; one contained 29 egg-clusters in an apple tree owned by Mrs. McInconey on Robbins Avenue, the other eight egg-clusters in oak and walnut trees owned by Peter Albersom on Church Street. Spraying was done by Federal men at both places.

Two large colonies were found in New Britain by Federal men, one of 11 egg-clusters on Maple Street in mixed growth on the property of P. J. Curtiss, and the other was in the center of the town on land owned by Peter Kalashenok, containing 83 egg-clusters. Thirty-six trees were banded and later 12,000 trees sprayed by Federal men.

In Rocky Hill two colonies were found, one of four egg-clusters on willows on the Connecticut River bank in the southeastern corner of the town, and the other of two egg-clusters was on Parsnig Street on apple trees owned by W. F. Griswold. The work in this town was done by Federal men.

State men found two colonies in South Windsor which are worthy of mention. One of 18 egg-clusters occurred in maple trees in the center of the town, and the other, containing 12 egg-clusters, was in the northwestern corner of the town on poplar trees owned by Mrs. Louis Speny. The other four infestations were all small and not dangerous.

No roadside scouting was done in Simsbury this year, but early in the fall 1,247 acres of woodland were scouted and nothing found.

Other towns in Hartford County that were scouted and found free from the gipsy moth were Plainville, Southington and Suffield.

Litchfield County.

The work in Litchfield County was done by the Federal forces. Six towns were found to be infested with the gipsy moth, namely: Canaan, Goshen, Litchfield, Plymouth, Salisbury and Winchester; these towns were very slightly infested.

In Canaan three colonies were found, the largest being one of eight egg-clusters in apple and elm trees owned by Miss Ida L. Root, about one mile west of Wangum Lake; the other two were found in willow trees owned by N. C. Dean and W. E. Shepard, both in the Falls Village section of the town. At N. C. Dean's place the colony contained four egg-clusters, and that at W. E. Shepard's had seven egg-clusters.

One colony of eight egg-masses was found in Goshen on a willow tree owned by F. S. Johnson, just south of the Goshen Post Office.

Both colonies found in Litchfield were in the northeastern corner of the town on the State road between Litchfield and

Torrington; one had 12 egg-clusters and the other only a single egg-cluster, all on apple trees in a pasture owned by F. W. Fuessenick and P. C. Burke.

In Plymouth one colony of 16 egg-clusters was found in some oak and maple trees owned by H. Mahoney, this colony being located in the southeastern corner of the town near Hancock Station.

Two large colonies were found in Salisbury on land owned by T. Burnetti about one mile north of Salisbury Post Office on the western side of Moore Brook; one in white oak growth contained 31 egg-masses and the other in apple trees had 21 egg-masses. Two other small infestations were also found in this town, one a single egg-mass on an apple tree owned by C. C. Lansing in Amesville, and another of three egg-clusters in a white oak owned by F. E. Howd about one mile north of Lakeville.

In Winchester one egg-cluster was found on an apple tree in Winchester Center, owned by E. W. Esenlohr, and a colony of eight egg-clusters on apple trees owned by W. W. Greene in Winsted.

In the spring and early summer 166 trees were banded and later 113 trees and five and three-fourths acres of woodland were sprayed at the above mentioned infestations.

The following towns in Litchfield County were scouted but no gipsy moths found in them: Kent, Morris, North Canaan, Sharon, Thomaston, Torrington, Warren, Watertown and Washington.

Middlesex County.

The entire County was scouted, except portions of the towns of East Haddam and Killingworth, which were not completed, although considerable work was done in them. Two towns were found infested with gipsy moths, Old Saybrook and Middletown.

In Old Saybrook two single egg-clusters were found, one on the Frank Negrelli Estate in the northern part of the town, and the other on property owned by Mrs. Bogue about one mile southwest of Saybrook Junction.

In Middletown two infestations of two egg-clusters each were found in the southeastern corner of the town on land owned by August Strom and the Green Meadow Club. Two infestations, one of two and another of one egg-cluster, were found on land owned by C. L. Johnson near Bear Hill. The last infestation was a single egg-mass on land owned by C. S. Wadsworth near Long Hill.

The towns of Chester, Clinton, Cromwell, Durham, East Hampton, Essex, Haddan, Portland, Saybrook and Westbrook were scouted but no trace of the pest found. The work in this County was all done by Federal men.

New Haven County.

Four towns were found infested with the gipsy moth in New Haven County this year, namely: Cheshire, Wallingford, Waterbury and Wolcott, one colony being found in each town.

The colony in Cheshire was one of 31 egg-clusters found in maple trees owned by A. H. Northrop, in the northeastern corner of the town near the Southington line.

The colony in Wolcott was a reinfestation from last year's colony, and was in oak trees owned by Peter Fontano about one mile north of Wolcott Post Office, containing seven egg-clusters; last year 19 were found and it is hoped that this colony has now been eradicated.

The Waterbury colony was one of eight egg-masses in maple trees owned by Mike Jenity of 792 Highland Avenue.

The gipsy moth has again made its appearance in Wallingford, but not in such abundance as in 1909, when more than 8,000 egg-clusters were creosoted. This year only three egg-clusters were found in an orchard owned by George Scards about a mile west of Pistapaug Pond.

At the above mentioned colonies, 33 trees were banded and 26 sprayed in the spring and early summer.

Other towns in this County which were scouted and not found infested were: Hamden, Meriden, Middlebury, Naugatuck, North Haven and Prospect. The work in this County was done by Federal men.

Spraying.

The foregoing summary has not covered the spraying done by the State department. The reason for this is that the Federal and State departments have a different method of reporting this branch of the work.

During this spraying season the weather was very favorable, practically no time being lost on account of rainy weather. This, together with the generosity of the Federal Bureau in lending the State a complete spraying truck and driver, are the two factors that enabled the State department to spray all of the infestations which needed spraying in the Counties of Windham, New London, Tolland and Hartford, east of the Connecticut River. The table of statistics shows the number of colonies sprayed in each town.

Statistics of Infestations.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—15 Towns Infested.					
Ashford	19	400	7	169	240
Brooklyn	25	329	21	237	40
Canterbury	6	98	5	22	3
Chaplin	7	86	6	105	26

STATISTICS OF INFESTATIONS—*Continued.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—*Concluded.*					
Eastford	44	1,211	15	278	961
Hampton	7	89	7	87	262
Killingly	13	193	9	85	189
Plainfield	4	68	11	82	100
Pomfret	18	145	7	37	843
Putnam	22	311	18	115	346
Scotland	10	57	2	10	3
Sterling	4	56	12	102	26
Thompson	78	1,361	19	390	543
Windham	18	233	9	65	63
Woodstock*	7	207	0	0	0
	282	4,844	148	1,784	3,645
New London County—17 Towns Infested.					
Bozrah	1	1	0	0	0
Colchester	1	5	1	4	5
East Lyme	9	52**	0	0	0
Griswold	17	144	6	47	41
Groton	33	137	10	60	21
Lebanon	3	27	3	40	2
Ledyard	9	27	2	15	15
Lisbon	3	10	0	0	375
New London	10	25	4	34	26
Norwich	7	36	3	9	1
No. Stonington	1	17	0	0	0
Old Lyme	3	32	0	0	0
Preston	3	40	1	12	410
Sprague	3	24	2	25	0
Stonington	25	367	15	184	71
Voluntown	12	53	2	7	817
Waterford	3	6	2	6	33
	143	1,003	51	443	1,817
Tolland County—10 Towns Infested.					
Andover	2	22	1	7	4
Bolton	2	17	1	6	0
Columbia	3	8	2	12	5
Ellington	21	284	9	75	156
Hebron	1	3	1	25	0
Somers	41	360	16	149	28
Stafford	142	1,281	25	233	2,038
Tolland	11	67	1	7	1
Union	26	467	14	154	146
Vernon	13	129	4	20	19
	262	2,638	74	688	2,397

* In Woodstock, only woodland scouting was done, in late summer.
** Plus one pupa.

STATISTICS OF INFESTATIONS—*Continued.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Trees Sprayed	No. Larvae Destroyed	No. Bands Applied	No. Miles Roadway Scouted
Hartford County—10 Towns Infested.						
Berlin	3	16	32	0	14	67
Bloomfield	5	68	40	0	23	38
Bristol	2	28	50	0	10	104
East Windsor	10	298	66	359	0	79
Enfield	9	74	97	347	0	102
New Britain	2	94	1,200	0	36	40
Newington	2	37	1	0	1	37
Plainville	0	0	0	0	0	53
Rocky Hill	2	6	0	0	0	40
Southington	0	0	0	0	0	110
South Windsor	6	39	113	14	0	60
Suffield	0	0	0	0	0	3
Windsor Locks	1	4	0	0	0	10
	42	664	1,599*	720	84	*743
Litchfield County—6 Towns Infested.						
Canaan	3	19	83	0	63	52
Goshen	1	1	0	0	20	95
Kent	0	0	0	0	0	15
Litchfield	2	13	5	0	13	51
Morris	0	0	0	0	0	44
North Canaan	0	0	0	0	0	19
Plymouth	1	16	0	0	22	79
Salisbury	4	56	15	0	59	105
Sharon	0	0	0	0	0	5
Thomaston	0	0	0	0	0	55
Torrington	0	0	0	0	12	58
Warren	0	0	0	0	0	33
Washington	0	0	0	0	0	38
Watertown	0	0	0	0	0	93
Winchester	2	9	10	0	11	112
	13	114	113**	0	200	854
Middlesex County—2 Towns Infested.						
Chester	0	0	0	0	0	37
Clinton	0	0	0	0	0	52
Cromwell	0	0	0	0	0	42
Durham	0	0	0	0	0	64
East Haddam	0	0	0	0	0	14
East Hampton	0	0	0	0	0	18
Essex	0	0	0	0	0	37
Haddam	0	0	0	0	0	125
Killingworth	0	0	0	0	0	76
Middlefield	0	0	0	0	0	35
Middletown	5	8	37	0	23	167
Old Saybrook	2	3	0	0	0	36
Portland	0	0	0	0	0	69
Saybrook	0	0	0	0	0	33
Westbrook	0	0	0	0	0	36
	7	11	37	0	23	841

* Also 2.5 acres of woodland sprayed; and 175 acres of woodland scouted in Berlin and 1,247 acres in Simsbury.

** Also 5.75 acres of woodland sprayed.

STATISTICS OF INFESTATIONS—*Concluded.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Trees Sprayed	No. Larvae Destroyed	No. Bands Applied	No. Miles Roadway Scouted
New Haven County—4 Towns Infested.						
Cheshire	1	29	8	0	4	93
Hamden	0	0	0	0	0	48
Meriden	0	0	0	0	0	96
Middlebury	0	0	0	0	0	76
Naugatuck	0	0	0	0	0	86
North Haven	0	0	0	0	0	20
Prospect	0	0	0	0	0	35
Wallingford	1	3	0	0	17	116
Waterbury	1	8	8	0	6	142
Wolcott	1	7	10	0	6	53
	4	47	26	0	33	765

SUMMARY OF STATISTICS.

County	No. Towns Covered	No. Infestations	No. Egg-Clusters Destroyed	No. Infestations Sprayed	No. Trees Sprayed	No. Lbs. Arsenate Used	No. Trees Banded	No. Larvae Destroyed	No. Miles Roadway Scouted
Windham	15	282	4,844	148	0	1,784	0	3,645	0
New London	20	143	1,003*	51	0	443	0	1,817	0
Tolland	10	262	2,638	74	0	688	0	2,397	0
Hartford	15	42	664	0	1,599†	0	84	720	743‡
Litchfield	15	13	114	0	113†	0	200	0	854
Middlesex	15	7	11	0	37	0	23	0	841
New Haven	10	4	47	0	26	0	33	0	765
	100	753	9,321*	273	1,775	2,915	340	8,579	3,203

PARASITES LIBERATED IN 1923.

Full details regarding the parasites of the gipsy moth and their distribution in Connecticut may be found in the Report of this Station for 1922 (22nd Report of the State Entomologist), page 313. The Japanese egg parasite, *Schedius kuvanae* How., is mentioned on page 315. During 1923, large numbers of these tiny parasites were sent into Connecticut from the Government Parasite Laboratory at Melrose Highlands, Mass., and put out by Mr. McEvoy in the more thickly infested gipsy moth territory in the eastern part of the State, particularly Windham and New London Counties. The number of individual parasites liberated in each town are as follows:

WINDHAM COUNTY.

Ashford	64,000	Plainfield	20,000
Brooklyn	56,000	Pomfret	60,000
Canterbury	24,000	Scotland	32,000
Chaplin	24,000	Sterling	17,850
Eastford	96,000	Windham	32,000
Hampton	40,000		

* Also 1 pupa.

† Also 2.5 acres woodland in Hartford County and 5.75 acres in Litchfield County, sprayed.

‡ Also 1,422 acres of woodland scouted in Hartford County.

TOLLAND COUNTY.

Somers	20,000	Stafford	24,000

NEW LONDON COUNTY.

Colchester	4,000	North Stonington	4,000
East Lyme	17,900	Norwich	24,000
Griswold	40,000	Old Lyme	12,000
Groton	20,000	Preston	12,000
Lebanon	9,850	Sprague	12,050
Ledyard	12,000	Stonington	28,000
Lisbon	20,000	Voluntown	32,000
New London	28,000	Waterford	12,000

Windham County	465,850
Tolland County	44,000
New London County	287,800
Total liberated in 1923	797,650
" " " 1922	904,000
" " " 1921	1,598,775
Total liberated in Connecticut	3,300,425

APPROPRIATIONS.

The appropriation for the biennial period ending June 30, 1923, was $60,000.00. On account of the extensive increase because of wind-spread, it became apparent that more money would be needed and the legislature then in session was asked for an additional $10,000.00. This was granted in the form of a deficiency appropriation and became immediately available for the remainder of the fiscal period. The legislature also granted the full amount requested ($100,000.00) for the biennial period ending June 30, 1925.

GIPSY MOTH SUPPRESSION ACCOUNT.

Financial Statement.

RECEIPTS

Appropriation for biennial period ending June 30, 1923	$60,000.00
Expended, year ending June 30, 1922	30,301.77
Balance	$29,698.23
Deficiency appropriation, 1923	10,000.00
	$39,698.23

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1923.

Salaries and Wages	$31,163.59
Printing and Illustrations	32.65
Postage	.50
Stationery	41.73
Telegraph and Telephone	19.66
Insurance (supplies including horse sprayer)	51.40
Spraying Supplies	2,200.60

Machinery, Tools and Supplies		$ 280.11	
Express, Freight and Cartage		63.51	
Rental and Storage		441.00	
Automobiles: New	$1,240.44		
Insurance	172.86		
Supplies and Equipment	730.40		
Repairs	878.49		
Gasoline	1,729.39		
Oil	78.47		
		$4,830.05	
Traveling Expenses		229.94	
Inspection of Imported Nursery Stock		288.11	
Heat and Light		55.10	
			$39,697.95
Balance			.28
			$39,698.23

EXPERIMENTS IN DUSTING VERSUS SPRAYING IN CONNECTICUT APPLE ORCHARDS IN 1923.

By M. P. Zappe and E. M. Stoddard.

The experiments with dusts in comparison with sprays for the control of various insect and fungous pests of apple and peach orchards begun in 1920 have been continued each year since. In 1923, only apple orchards were treated, and though the results so far as the control of insects are concerned do not differ greatly from the results of preceding years, it seems best to present them here as a matter of record.

The results of preceding experiments along this line may be found in the publications of this Station as follows: Report for 1920, page 168, results of 1920; Bulletin 235, results of 1921; Bulletin 245, results of 1922.

Acknowledgments.

The writers are indebted to Mr. Frank N. Platt of Milford for the use of his orchard, power sprayer and for other assistance in conducting these experiments. Mr. George Graham helped in the application of the spray and dusts and in the work of harvesting and scoring the fruit. Messrs. B. H. Walden, J. L. Rogers, T. F. Cronin and S. R. Hamilton also helped in harvesting and scoring the fruit.

Orchards Under Experiment.

Only two apple orchards were used for this work in 1923, and both have been used in the prior tests. The largest of these was the orchard of Frank N. Platt, Milford, containing 285 trees, 19 years old. The other was the old orchard at the Station Farm, Mount Carmel, containing 40 trees about 47 years old.

Apparatus Used.

The spray outfit was the same as used in preceding experiments, a Friend power sprayer with tank of 200 gallons capacity. Two lines of hose were used with two nozzles on each rod, carrying between 175 and 200 pounds pressure. The duster was a Niagara power outfit purchased new in 1923. It was mounted upon skids so that it could be readily transferred to an automobile truck. It is similar to the duster used in preceding experiments except that it is lighter, has an improved type of engine and blower and so probably gave somewhat better results.

Materials.

For the spray solutions the following materials were used:

Lead arsenate	3 pounds
Liquid lime-sulphur	3 gallons
Casein spreader	¾ pound
Water	100 gallons.

Only two kinds of dust were used in the tests in 1923. One was a sulphur-lead-arsenate dust containing fine sulphur, 90 parts, and lead arsenate, 10 parts. The other was a copper-arsenic dust containing 5.75 per cent. of metallic copper and 2.75 per cent. of metallic arsenic. The percentage of lime was not determined. When applied to moist foliage this dust immediately turns a bluish color, indicating the formation of a Bordeaux mixture on the foliage.

Number and Time of Applications.

Seven applications were made in the Milford orchard on the following dates:

1. Delayed dormant.....April 25–26.
2. Prepink, treatment.....May 4.
3. Pink, treatment.....May 10.
4. Calyx, first after blossoming.....May 24–28.
5. Second after blossoming.....June 12.
6. Third after blossoming.....July 6.
7. Fourth after blossoming.....August 1.

At the Station Farm, only dusts were used, three applications being made after blossoming, on May 29, June 13 and July 12-13.

Recording Data.

Trees which blossomed freely were selected as count trees. The fruit was kept separate and each apple scored for insect and fungous injury. All injuries on each fruit were recorded, even though slight, and often several kinds of injury were noted on a single apple; in such cases all types of injury were recorded separately. Later these figures were tabulated and percentages obtained. Altogether this work necessitated the separate handling and scoring of 144,895 individual apples, equivalent to about 362 barrels.

Milford Orchard.

The experiments in this orchard included four varieties: Gravenstein, McIntosh, Baldwin and Greening, but only the McIntosh

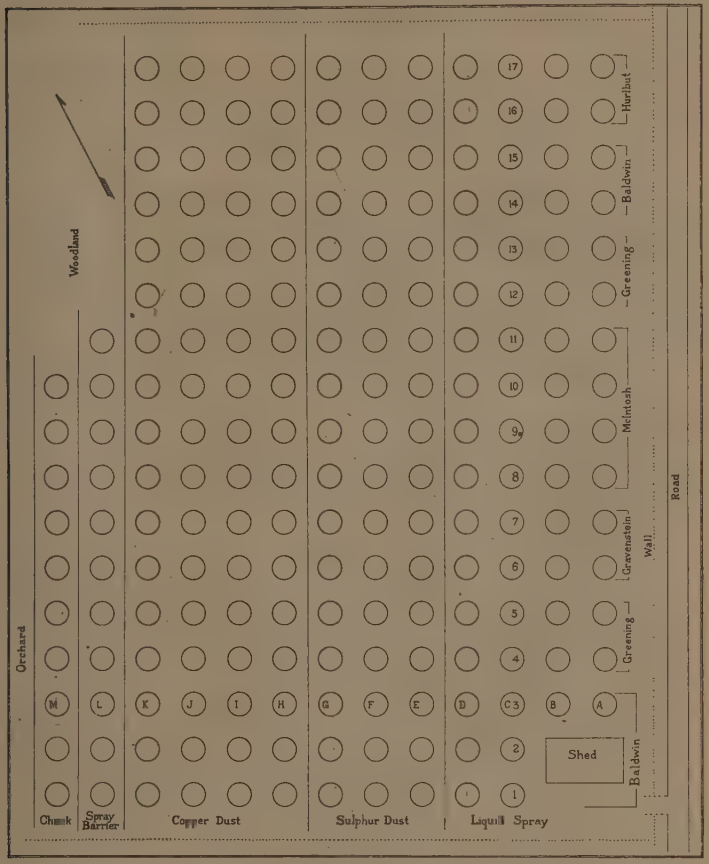

Figure 10. Plan showing arrangement of experimental plots in orchard of Frank N. Platt, Milford, where experiments in dusting and spraying were conducted in 1923.

produced a good crop of fruit. The other varieties bore a very light crop and in some plots there were not enough apples of one variety to give adequate data. The plots were so arranged that each plot contained trees of each variety.

The arrangement of the plots is shown in Figure 10, and was as follows: beginning on the east side, the first four rows were sprayed. Rows five to seven were dusted with sulphur-arsenate dust. Rows eight to 11 were dusted with copper-arsenic dust. Row 12 was sprayed and acted as a barrier to keep the dust from being blown from row 11 to row 13, which was untreated and used as a check.

The first treatment in this orchard was the delayed dormant spray of lime-sulphur which was applied over the entire orchard on April 25 and 26. Liquid lime-sulphur, 1-9, was used on the south half of the orchard, and Sherwin-Williams dry lime-sulphur, 25-100, on the north half.

The next treatment was the prepink application on May 4 on the Gravenstein, McIntosh and Greening varieties in the copper-arsenic dust plot only. The other plots were not treated until the next application.

The pink application was given to all varieties in all plots on May 10. The spray was applied first because it was too windy for dusting. Later in the day towards sunset the wind subsided and the dust was applied.

The first treatment after blossoming was applied to the McIntosh trees on May 24. All other varieties in all plots were treated May 28.

The second treatment after blossoming was applied on June 12. The foliage was damp when the dust was applied but had become dry before the liquid spray was applied. There was almost no wind blowing on this date.

The third treatment after blossoming was given on July 6, covering all except one row in each plot, and these rows received no further treatment. The copper-arsenic dust plot began to show considerable scab infection on both the leaves and the fruit. It appeared as though the copper-arsenic dust would not control the scab, so the 90-10 sulphur-arsenate dust was substituted.

The last or fourth treatment after blossoming was applied on August 1, to all except two rows in each plot. The untreated rows included those not given the preceding treatment and one additional row. As before, the sulphur-arsenate dust was substituted for copper-arsenic dust in the copper-arsenic dust plot. Fungous injury was very light except in the case of scab on McIntosh, on all the treated plots and all such injuries are listed under the heading of "all fungi", except in Table 1.

TABLE I. RESULTS OF TREATMENTS. MCINTOSH.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	Scab
			SPRAY.				
3	0	.29	.29	4.22	93.1	.94	1.55
4	0	.51	.09	2.79	91.5	1.3	3.8
5	0	.36	.02	1.78	96.7	.402	.825

			SULPHUR-ARSENATE DUST.				
3	0	1.26	.17	4.4	87.	1.37	5.27
4	0	1.21	.08	3.72	87.	1.21	7.09
5	0	3.14	.06	4.3	87.5	.68	4.29
			COPPER-ARSENIC DUST.				
4 cop.-ars.	.06	6.2	.19	9.08	19.5	3.26	73.7
4 cop.-ars. / 1 sulp.-ars.	0	4.7	.11	5.1	39.1	2.28	54.5
4 cop.-ars. / 2 sulp.-ars.	0	5.52	.165	8.13	51.5	2.63	27.1
			CHECK.				
No treatment	.134	8.05	9.7	51.0	.335	12.8	96.5

Discussion of Data in Table I.

In nearly every case, plots receiving four and five applications produced a slightly higher percentage of perfect fruit and a lower percentage of injured fruit than plots receiving fewer applications, except in case of the copper dust, where the differences are much greater. Comparing the spray and dust treatments, the former gave slightly better control of all insects, and much better control of scab than either of the dust treatments.

The sulphur-arsenate dust proved more effective against scab than the copper-arsenic dust. McIntosh is a variety much subject to scab attack, and though it was seemingly not a serious scab season, the check or untreated trees showed 96.5 per cent. of scab injury. Where copper-arsenic dust alone was applied this percentage was reduced only to 74, but where sulphur-arsenate dust was substituted for one application the scab injury was cut to 54, and where sulphur-arsenate dust was substituted for two applications, scab injury was still further reduced to 27 per cent. As scab control was the chief aim on this variety, the copper-arsenic dust alone proved very inefficient. On the other hand, where sulphur-arsenate dust was applied in every application scab injury did not go much above seven per cent., while on the sprayed trees it was less than four per cent. The sulphur-arsenate dust was slightly better than the copper-arsenic dust for the control of all insects, though not quite equal to the liquid spray.

The data regarding Gravenstein are presented in Table II.

Table II. Results of Treatments. Gravenstein.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY.				
3	8.62	.5	.18	16.3	73.7	1.19	.25
4	3.9	.72	.07	20.8	74.4	.59	.13
5	2.26	.22	0	18.1	79.	.101	.11
			SULPHUR-ARSENATE DUST.				
3	3.64	.178	0	26.3	70.	1.07	0
4	12.8	0	0	26.4	60.8	2.48	.22

			COPPER-ARSENIC DUST.				
4 cop.-ars.	1.03	.079	.55	79.	17.3	7.35	.44
4 cop.-ars. 2 sulp.-ars.	11.5	.222	0	31.6	56.3	3.22	.21
			CHECK.				
No treatment	.65	1.9	5.64	84.	4.05	6.95	49.8

Discussion of Data in Table II.

As the Gravenstein trees bore a light crop of fruit, the data shown in Table II were obtained from comparatively few apples, but are given here for what they are worth. The plots receiving five applications of sulphur-arsenate dust and four applications of copper-arsenic dust bore no apples, so no data are available for these plots. In general the sprayed plots gave a slightly higher percentage of perfect fruit and lower percentages of insect injury than either of the dust plots, and the sulphur-arsenate dust gave rather better results than the copper-arsenic dust. Fungi were inconspicuous on the treated plots, but were conspicuous on the checks, especially Brooks fruit speck.

Similar data on Greening are shown in Table III.

Table III. Results of Treatments. Greening.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY				
3	4.32	2.54	1.78	14.2	72.6	2.52	.81
4	5.07	2.56	1.08	7.15	83.	.9	.16
5	1.	2.3	.35	12.1	80.6	1.95	1.4
			SULPHUR-ARSENATE DUST.				
4	.68	.82	1.37	12.1	79.	3.65	1.5
5	.25	.07	.96	6.9	81.9	1.71	1.5
			COPPER-ARSENIC DUST.				
4 cop.-ars.	0	0	3.	36.	52.2	17.2	.74*
4 cop.-ars. 1 sulp.-ars.	0	1.46	23.5.	75.	8.8	3.68	6.87*
4 cop.-ars. 2 sulp.-ars.	0	.036	1.81	26.1	60.5	5.43	3.47
			CHECK.				
No treatment	0	8.37	36.	63.6	.24	30.5	43.9

Discussion of Data in Table III.

The Greening crop was also very light and no counts of fruit could be made in the sulphur-arsenate dust plot receiving three applications. There was little difference in the percentages of perfect fruit between the plots treated with liquid spray and with sulphur-arsenate dust; both were better than the copper-arsenic

*Very little fruit in this plot.

dust plot where the percentage of perfect fruit was very low, due largely to curculio injury which ran high. Injury by fungi was best controlled by the spray and sulphur-arsenate dust.

The data on Baldwin are given in Table IV.

TABLE IV. RESULTS OF TREATMENT. BALDWIN.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY				
3	.81	.32	.16	12.7	85.	1.05	0
5	.16	.44	1.26	31.7	65.9	1.13	0
			SULPHUR-ARSENATE DUST.				
3	.71	.98	1.23	19.3	75.	2.8	.7
4	2.54	1.88	.94	31.9	56.4	4.23	0
5	.09	.86	.23	16.4	80.	2.1	.01
			COPPER-ARSENIC DUST.				
3 cop.-ars.	.59	4.27	1.57	33.5	51.7	7.7	4.02
3 cop.-ars. 2 sulp.-ars.	1.87	4.56	.04	22.7	72.3	2.2	.61
			CHECK.				
No treatment	.22	.44	8.95	42.7	19.	13.8	37.2

DISCUSSION OF DATA IN TABLE IV.

As was the case with Gravenstein and Greening, the Baldwin crop was light and in the plot receiving four spray applications and that receiving four applications of copper-arsenic dust plus one of sulphur-arsenate dust there were no trees which bore fruit; consequently no data could be gathered for these plots. There is little difference here between the liquid spray and sulphur-arsenate plots, and both gave better results than the copper-arsenic dust plots. The percentage of fungous diseases was negligible in the treated plots, but ran quite high in the check plot.

STATION ORCHARD, MOUNT CARMEL.

In this orchard both sulphur-arsenate dust and copper-arsenic dust were used but no liquid spray was applied. Only two varieties, Baldwin and Greening, were under experiment, and on account of the light crop of fruit, the data from both varieties are included in Table V. Each plot received only three treatments of dust, all after blossoming. The calyx treatment was made May 29, and the subsequent applications made June 13 and July 12 and 13. Such data as were obtained are given in Table V as follows:

TABLE V. RESULTS OF TREATMENT. BALDWIN AND GREENING.

Treatment	Aphis	Codling Moth	Curculio	Good	Other Insects	All Fungi
Sulphur-arsenate dust.	7.36	5.95	40.1	43.1	5.74	1.32
Copper-arsenic dust...	2.42	4.48	36.6	54.4	4.1	2.07
Check.....	6.2	22.4	72.5	15.5	6.62	4.45

Discussion of Data in Table V.

In this orchard for some unexplained reason the copper-arsenic dust gave slightly better results in the control of curculio, codling moth and "other insects" than the sulphur-arsenate dust. This is at variance with the results obtained in the Milford orchard where the sulphur-arsenate dust treatment gave higher percentages of perfect fruit and lower percentages of insect injury than the copper-arsenic dust. Fungous troubles were not prominent, though reduced slightly by both treatments.

Conclusions.

In 1923, as in the preceding seasons of 1920, 1921 and 1922, when similar experiments were conducted by this Station, the liquid spray has given somewhat better results in the control of injurious insects and fungi on apple trees in Connecticut than any of the dust mixtures. The difference has not been so great in the control of insects as in the control of fungous diseases. The highest percentage of perfect fruit was obtained from the experimental plots treated with liquid spray.

The sulphur-arsenate dust gave fair control of insect pests and of fungous diseases, particularly apple scab.

The copper-arsenic dust in most cases gave nearly as good control of insect pests as the sulphur-arsenate dust, but was much less effective in controlling fungous diseases, though much better than no treatment.

The season of 1923 was characterized by little rainfall and consequently fungous diseases were not so prevalent as in a normal season or a very moist season. It seems to the writers quite probable that in a dry season like 1923, the dust mixtures would be far more satisfactory than in a wet season or even in a normal season when fungous diseases are more prevalent. It is also probable that in the presence of a greater amount of moisture the copper-arsenic dust would be changed into a sort of Bordeaux mixture on the leaves and might under such conditions compare more favorably with the sulphur-arsenate dust than was the case in this unusually dry season of 1923. It is also probable that in a dry season with rather high temperature like 1923, the sulphur-arsenate dust would be more effective as a fungicide than in a cool moist season.

Any orchardist wishing to grow choice fruit should not discard his spraying outfit in favor of a dusting equipment and should not skimp in the number of the applications and quantity of spray applied. On the other hand, if orchards are on elevated slopes with good air drainage and not seriously attacked by fungous diseases, a fair grade of commercial fruit can be grown by the dust treatment. Where the water supply is not convenient and help is difficult to obtain, the dust method might be followed advantageously.

TESTS OF SODIUM HYPOCHLORITE FOR CONTROL OF AMERICAN FOUL BROOD OF BEES.

By Philip Garman.

Two different substances have been advertised recently as cures for bee diseases. Sodium hypochlorite solution sold under the trade name of "Be-Helth" was recommended so highly for this purpose that it was given a trial.

Sodium hypochlorite (NaOCl) is an electrolized salt, the disinfectant property of which depends upon the ease with which it gives up its oxygen to oxidizable organic matter. After oxidation, sodium chloride (NaCl) is left, and this being ordinary salt is harmless to bees. Sodium hypochlorite is used in the dairy industry for sterilizing milk pails, etc., and it is also the principal constituent of Dakin solution used in treatment of wounds during the recent war. It is a product costing a few cents a gallon to manufacture according to various chemists. Its bleaching action is quite marked, being similar in this respect to calcium hypochlorite or bleaching powder. It is also the principal constituent of "Labarraque solution" used by scientists for many years in dissolving or softening chitin contained in the hard parts of insects. This dissolving and bleaching action make it theoretically ideal for use against bee diseases where it is necessary to dissolve dead scales and penetrate masses of diseased tissue.

Four frames of brood badly diseased with American foul brood were obtained from our inspectors, Messrs. Yates and Coley, during the summer of 1923. Three of these combs were removed from the frames and the frames sterilized by spraying with a concentrated solution of "Be-Helth". The fourth comb was not removed from its frame, but was sterilized by soaking for 24 hours in the concentrated solution. It required nearly three-fourths of a gallon for this purpose, but special care was taken to fill every cell with the material. For experimental purposes two three-frame nuclei were used and one disease-free ten-frame hive of Italian bees. In one of the nuclei, two of the sterilized frames with new foundation were placed together with a healthy frame of brood from another hive. The fourth frame with new foundation was placed direct in a ten-frame hive known to be free of disease. All this was done July 17, 1923.

Examination of the two nuclei and the ten-frame hive on August 9 showed one queen cell (in the nucleus containing treated brood comb) with typical American foul brood. No sign of the disease was seen elsewhere.

Examination August 29 showed American foul brood in every frame of the nucleus containing the supposedly sterile brood comb. None was, however, found in hive or nucleus containing brood frames only. The nucleus containing foul brood was destroyed

and close watch kept upon all other treated colonies, but no disease developed in any other place.

While no definite conclusions can be drawn from the results obtained, they indicate the risk involved in attempting control in comb actually containing American foul brood. The manufacturers no longer recommend its use for that purpose, in fact, but are advocating sterilization of super combs and hive equipment for which it may be successful as indicated by our experience with infected frames without comb. The greatest difficulty lies in the extreme thoroughness with which the work must be done to insure success. Thus even with the greatest care it is almost impossible to reach all parts of a comb with sufficient solution to kill the organism. It has been demonstrated by White[1] that the spores of *Bacillus larvae* causing American foul brood are very resistant to chemical disinfectants, and this together with the information above should make one cautious about placing too much confidence in the use of the material.

ANALYSIS of "BE-HELTH"[2]

	Grams per 100 cc.
Available chlorine	3.77
Total chlorine	3.81
Sodium hypochlorite	3.96
Sulphates	Trace.

Available chlorine was determined 33 days after the first analysis and was found to be 3.70 grams per 100 cc.

FURTHER EXPERIENCE WITH PARADICHLORO-BENZENE AS A REMEDY FOR PEACH BORERS.

BY M. P. ZAPPE.

For several years this material has been recommended and used to destroy the larvae of the peach borer, *Synanthedon exitiosa* Say. When applied properly, good control is obtained, and it takes less time to make the application than it does to "worm" the trees.

Usually it is customary to clear the ground of weeds and rubbish near the base of the tree, then sprinkle about an ounce of the granular paradichlorobenzene in a circle around the base of the trunk and about an inch from the bark and not touching it. Soil free from rubbish is then banked around the tree covering the insecticide and packed closely against the bark.

The first test of this material was made at the Station Farm at Mount Carmel in September, 1921, and the results published in the

[1] White, G. F. American Foul Brood. U. S. D. A., Bureau of Entomology, Bulletin 809; 1920.

[2] Made by the Department of Chemistry, Connecticut Agricultural Experiment Station.

Report of the Station for 1922, page 331. In the fall of 1922, another application was made. These trees had then been set 11 years. There were five rows of peach trees with 30 trees in each row. Four rows were treated and one row was left untreated for a check. The material was applied October 4 and 5, and was allowed to remain until the following spring without being uncovered.

On June 14, all trees were carefully examined and records kept of all borers found. The results appear in the following table:

	No. of Trees	Total No. of Borers	Living Borers Above Soil	Living Borers Below Soil	Dead Borers Above Soil	Dead Borers Below Soil
Treated	107	71	23	0	7	41
Untreated	21	42	34	7	1	0

The results show that all borers below the surface of the soil were killed by the treatment, and that the only ones remaining alive were those above the surface of the soil where the fumes of the paradichlorobenzene could not affect them. A few dead borers were found above the surface of the soil, but probably their burrows opened below the soil surface so that they were penetrated by the fumes. In the untreated row only one dead borer was found and that was above the soil surface.

THE EUROPEAN CORN BORER IN CONNECTICUT.

Pyrausta nubilalis Hubn.

This destructive introduced pest, first discovered in this country in eastern Massachusetts in 1917, has continued to spread in that locality until the infestation involves fully half of Massachusetts, southwestern Maine, southern New Hampshire and a large portion of Rhode Island. The pest is also present in two large areas in New York State, one around Albany and Schenectady, which has spread into two towns in southwestern Vermont, and the other in western New York, this latter area extending along the southern shore of Lake Erie through the lake portions of Pennsylvania, Ohio, a few towns in Michigan and a large area in Ontario. According to the understanding of the writer these infestations around Lake Erie are all connected.

It has been expected that the margin of the Massachusetts infestation would soon extend far enough to reach the northeastern corner of Connecticut, but though Federal scouts have searched for it in Thompson and Putnam, during September, they did not find it. On the other hand, late in the fall of 1923, Federal scouts discovered three small separate infestations along the shore region of Connecticut, two in Groton and one in Niantic in the town of East Lyme.

Scouting by State Men.

Mr. M. P. Zappe was in charge of this work and was assisted by J. Leslie Rogers. The coast region of the towns of West Haven and Milford back two miles from Long Island Sound was scouted, and in addition corn stalks were examined throughout the seed corn growing areas of Milford, Orange and Woodbridge. Similar seed corn growing regions south of the village of Wethersfield and the Long Hill section of Middletown were also scouted. This scouting was done in October, November and December, and the time expended on this work was equivalent to 46 man days. In this scouting work no signs of the European corn borer were found.

Scouting by Federal Men.

According to data received from Mr. L. H. Worthley, expert in charge of European corn borer control, the Federal scouts began work in Connecticut on August 21, and continued through the remainder of the calendar year. They scouted the coast line two miles back from the shore from the Rhode Island State line westerly to West River and including New Haven, and from the Housatonic River to the New York State line. The section from New Haven to the Housatonic River was covered by State men as has already been explained. Mr. Arthur Viall, a Federal scout, worked for a few days with State scouts in Milford and Orange, as otherwise he would have been alone and without automobile transportation.

Federal scouts worked in Thompson from September 6 to 22, and in Putnam from September 19 to 25. Thus altogether the Federal men worked in Connecticut 319 man days, during which they traveled 4,430 miles, and scouted 4,876 corn fields having an area of 3,982 acres, and covered a territory estimated at 703 square miles. Three small and recent infestations were discovered along the shore in the eastern half of the State.

Infestations.

The first sign of infested material was found by Federal scouts in Groton on October 25, 1923. This was in a small patch of late sweet corn on land owned by Mr. C. A. Miller, Plant Avenue, opposite Golf Club House. Here 13 larvae were collected, though there were others in the corn stalks. It had every appearance of having become infested during the past season, and that these were the first brood larvae to appear in the vicinity. So far as could be ascertained all were in the corn plants as none could be found in weeds or other vegetables growing in the garden close by.

In company with Mr. Zappe and with Federal men, Messrs. Richardson and Leach, the writer visited this infestation on November 10 to become familiar with conditions. Mr. C. Doer-

ing, caretaker for Mr. Miller, who lived on the place, offered full co-operation with our men in an attempt to clean up this infestation.

On November 27 and 28, Messrs. Zappe and Rogers attempted to clean the field of corn stalks, stubble and weeds at this infestation, but the material was so wet that it burned with difficulty. Consequently it was left to dry out before finishing the job. On December 4, Messrs. Zappe, Rogers and the writer met Mr. Worthley and Messrs. Richardson and Kelly of the Federal force, and made further attempts to burn the remaining corn stalks and trash. As it was still difficult to burn this material Mr. Worthley suggested that he send down from Arlington, Massachusetts, a large automobile power outfit for burning, and that we pay for the oil. This work was done on Friday and Saturday, December 7 and 8.

On December 3, another small infestation was discovered in sweet corn in a garden patch near the residence of James Pringle, on Poquonnock Road in Groton, some two miles east of the first infestation. The burning machine was used to clean up both of these infestations, all plant material above ground and corn stubble being burned. Altogether, the time devoted to this clean-up work by State men was equivalent to 10 man days.

Plates XIV-XVI show conditions before and after burning at both of these infestations.

On December 12, a third infestation was found in a garden in the village of Niantic, town of East Lyme. On the Charles Cone Estate, occupied by Chester Beebe, a small patch of sweet corn was slightly infested, only a few larvae being found. These were sent to the Corn Borer Laboratory and identified as *Pyrausta nubilalis* Hubn. At this writing, clean-up measures have not been carried out, but this will be done later.

Source of Connecticut Infestations.

The question at once arises, how did these Connecticut points become infested? From the Federal men, we learn that the American broom corn crop was light in 1922, and that it was necessary to import raw material to keep the factories in operation. Consequently, broom corn was imported from Europe, and a shipment arriving at the port of New York was found to be infested and was ordered fumigated. The large fumigating plant at the Bush Terminal in Brooklyn had so much material awaiting treatment that this shipment was ordered reshipped to Boston for fumigation in the Cambridge plant. *En route* the boats put into the harbors at Bridgeport and New London, and waited several hours in each harbor on account of storms. Before the cargo reached Boston the moths were found to be emerging. It is believed that these infestations originated in this way. There is also an infestation on Fishers Island about four miles off shore from Groton which may also have come from this shipment.

Federal and State Quarantines.

On account of the danger of transportating this pest in shipments of vegetables other than corn, the State quarantine was revised, effective June 1, 1923, and the quarantine order with explanations was published as Bulletin of Immediate Information No. 25, and distributed under date of May 28, 1923. This publication is reproduced in the following pages.

European Corn Borer Quarantine.

The European Corn Borer, *Pyrausta nubilalis* Hubner, which was first discovered in Massachusetts in 1917, and which has since spread throughout the eastern portion of that State and into Maine, New Hampshire and Rhode Island, now menaces Connecticut and may at any time appear within its borders, especially as the margin of the present infested area is only a few miles distant from the northeastern corner of Connecticut. In addition to the infested territory mentioned above, there is a separate infestation in the vicinity of Albany, N. Y., and another in western New York extending along the shore of Lake Erie, through Pennsylvania, Ohio, and into Michigan, connecting with an infested region in southern Ontario.

The pest is believed to have first entered the United States and Canada in broom corn imported from Europe and distributed at at least three and perhaps more different points. As the pest is now known to attack a large number of different kinds of plants including common vegetables which are shipped long distances, there is great danger that this insect may be transported and new colonies formed in this manner. Though the natural spread of the insect is several miles each season, it may be carried hundreds or even thousands of miles in commercial shipments. Hence quarantines have been established to prevent these commercial jumps. Connecticut first established a quarantine against this insect on September 20, 1918, and revised it on June 1, 1920. As there is much new infested territory not covered in the former quarantine, a new quarantine order has just been issued, effective June 1, 1923. This order follows:

STATE OF CONNECTICUT

Office of
Agricultural Experiment Station
New Haven, Conn.

QUARANTINE ORDER No. 5.

Effective June 1, 1923.

Whereas a very destructive insect, known as the European Corn Borer, *Pyrausta nubilalis* Hubner, exists in certain portions of the

States of Maine, New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, Ohio and Michigan, and threatens the corn growing industry of the country; and whereas there is grave danger that this insect may be brought into this State by the transportation of infested plants or parts of plants from the infested area:

Therefore, pursuant to the provisions of Section 2106 of the General Statutes, it is hereby ordered that no corn on the ear, stover, or other parts of the corn plant, broom corn, including all the parts of the stalk, all sorghums, sudan grass, celery, green beans in the pod, beets with tops, spinach, rhubarb, oat and rye straw as such or when used in packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus, and dahlia, except the bulbs thereof, without stems, shall enter Connecticut from the infested areas mentioned below, unless each shipment, car, box, bale, or package bear a valid certificate issued by an authorized Federal inspector, stating that the contents thereof have been examined and found free from infestation by the European Corn Borer. These restrictions do not apply to dry shelled kernels or cooked and preserved products, or products grown in non-infested territory passing through infested areas in transit.

Infested Areas.

Maine: Sebago in *Cumberland County;* Acton, Alfred, Berwick, Biddeford, Buxton, Cornish, Dayton, Eliot, Hollis, Kennebunk, Kennebunkport, Kittery, Lebanon, Limerick, Limington, Lyman, Newfield, North Berwick, Old Orchard, Parsonfield, Saco, Sanford, Shapleigh, South Berwick, Waterboro, Wells and York in *York County.*

New Hampshire: Alton, Barnstead, Belmont, Center Harbor, Gilford, Gilmanton, Laconia, Merideth, New Hampton, Sanbornton and Tilton in *Belknap County;* Brookfield, Effingham, Moultonboro, Ossipee, Tuftonboro, Wakefield and Wolfeboro in *Carroll County;* Alexandria, Ashland, Bridgewater, Bristol, Groton, Hebron, Holderness, Orange and Plymouth in *Grafton County;* Amherst, Antrim, Bedford, Bennington, Brookline, Deering, Francestown, Goffstown, Greenfield, Greenville, Hancock, Hillsborough, Hollis, Hudson, Litchfield, Lyndeboro, Manchester, Mason, Merrimack, Milford, Mount Vernon, Nashua, New Boston, New Ipswich, Pelham, Peterboro, Sharon, Temple, Weare, Wilton and Windsor in *Hillsborough County;* Allenstown, Andover, Boscawen, Bow, Bradford, Canterbury, Chichester, Concord, Danbury, Dunbarton, Epsom, Franklin, Henniker, Hill, Hooksett, Hopkinton, Loudon, Newbury, New London, Northfield, Pembroke, Pittsfield, Salisbury, Sutton, Warner, Webster and Wilmot in *Merrimack County;* Atkinson, Auburn, Brentwood, Candia,

Chester, Danville, Deerfield, Derry, East Kingston, Epping, Exeter, Fremont, Greenland, Hamstead, Hampton, Hampton Falls Kensington, Kingston, Londonderry, New Castle, Newington, Newton, New Market, Northampton, Northwood, Nottingham, Plaistow, Portsmouth, Raymond, Rye, Salem, Sandown, Seabrook, South Hampton, South Newmarket, Stratham and Windham in *Rockingham County;* Barrington, Dover, Durham, Farmington, Lee, Madbury, Middleton, Milton, New Durham, Rochester, Rollinsford, Somersworth and Strafford in *Strafford County.*

Massachusetts: Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Orleans, Provincetown, Sandwich, Truro, Wellfleet and Yarmouth in *Barnstable County;* Acushnet, Attleboro, Berkley, Dartmouth, Dighton, Easton, Fairhaven, Fall River, Freetown, Mansfield, New Bedford, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Somerset, Swansea, Taunton and Westport in *Bristol County;* Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfield, Wenham and West Newbury in *Essex County;* Acton, Arlington, Ashby, Ashland, Ayer, Bedford Belmont, Billerica, Boxboro, Burlington, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham, Groton, Holliston, Hopkinton, Hudson, Lexington, Lincoln, Littleton, Lowell, Malden, Marlboro, Maynard, Medford, Melrose, Natick, Newton, North Reading, Pepperell, Reading, Sherborn, Shirley, Somerville, Stoneham, Stow, Sudbury, Tewksbury, Townsend, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Westford, Weston, Wilmington, Winchester and Woburn in *Middlesex County;* Avon, Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover, Foxboro, Franklin, Holbrook, Hopedale, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Plainville, Quincy, Randolph, Sharon, Stoughton, Walpole, Wellesley, Westwood, Weymouth and Wrentham in *Norfolk County;* Abington, Bridgewater, Brockton, Carver, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Lakeville, Marion, Marshfield, Mattapoisett, Middleboro, Norwell, Pembroke, Plymouth, Plympton, Rochester, Rockland, Scituate, Wareham, West Bridgewater and Whitman in *Plymouth County;* Boston, Chelsea, Revere, and Winthrop in *Suffolk County;* Ashburnham, Berlin, Blackstone, Bolton, Boylston, Clinton, Douglass, Fitchburg, Gardner, Grafton, Harvard, Holden, Hubbardston, Lancaster, Leominster, Lunenburg, Mendon, Milford, Millbury, Northboro, Northbridge, Princeton, Rutland, Shrewsbury, Southboro, Sterling, Sutton, Upton, Uxbridge, Westboro, West Boylston, Westminster and Worcester in *Worcester County.*

Rhode Island: Barrington, Bristol and Warren in *Bristol County;* Little Compton, Middletown, Newport, Portsmouth and Tiverton in *Newport County;* Cumberland, East Providence, Lincoln, North Providence, Pawtucket, Providence and Woonsocket in *Providence County.*

New York (Eastern): Albany, Berne, Bethlehem, Cohoes, Colonie, Coeymans, Guilderland, Knox, New Scotland, Rensselaerville and Westerloo in *Albany County;* Bleecker, Broadalbin, Caroga, Ephratah, Johnstown, Mayfield, Northampton and Perth in *Fulton County;* Coxsackie, Greenville and New Baltimore in *Greene County;* Benson, Hope, Lake Pleasant and Wells in *Hamilton County;* Amsterdam, Canajoharie, Charleston, Florida, Glen, Minden, Mohawk, Palatine, Root and St. Johnsville in *Montgomery County;* Cherry Valley in *Otsego County;* Brunswick, East Greenbush, Grafton, Hoosick, North Greenbush, Petersboro, Pittstown, Poestenkill, Sand Lake, Schaghticoke and Troy in *Rensselaer County;* Ballston, Charlton, Clifton Park, Corinth, Day, Edinburg, Galway, Greenfield, Hadley, Half Moon, Malta, Milton, Moreau, Northumberland, Providence, Saratoga, Saratoga Springs, Stillwater and Wilton in *Saratoga County;* Duanesburg, Glenville, Niskayuna, Princetown, Rotterdam and Schenectady in *Schenectady County;* Carlisle, Cobleskill, Esperance, Fulton, Middleburg, Schoharie and Wright in *Schoharie County;* Luzerne in *Warren County;* Cambridge, Easton, Fort Edward, Greenwich, Hebron, Jackson and White Creek in *Washington County.*

(Western): Ashford, Dayton, East Otto, Ellicottville, Franklinville, Freedom, Leon, Little Valley, Machais, Mansfield, Napoli, New Albion, Otto, Perrysburg, Persia, Salamanca and Yorkshire in *Cattaraugus County;* Arkwright, Charlotte, Chautauqua, Cherry Creek, Clymer, Dunkirk, Ellery, Ellicott, Ellington, French Creek, Gerry, Hanover, Harmony, Mina, Pomfret, Portland, Ripley, Sheridan, Sherman, Stockton, Villenova and Westfield in *Chautauqua County;* Alden, Amherst, Aurora, Boston, Brant, Buffalo, Cheektowaga, Clarence, Colden, Collins, Concord, East Hamburg, Eden, Elma, Evans, Grand Island, Hamburg, Holland, Lancaster, Marilla, Newstead, North Collins, Sardina, Tonawanda, Wales and West Seneca in *Erie County;* Alabama, Batavia, Darien, Pembroke and Stafford in *Genesee County;* Cambria, Hartland, Lewiston, Lockport, Newfane, Niagara, Pendleton, Porter, Royalton, Somerset, Wheatfield and Wilson in *Niagara County;* Arcade, Attica, Bennington, Eagle, Gainsville, Java, Middlebury, Orangeville, Perry, Sheldon, Warsaw and Wethersfield in *Wyoming County.*

Pennsylvania: Beaver in *Crawford County;* Amity, Conneaut, Corry, Elk Creek, Fairview, Franklin, Girard, Greene, Greenfield, Harbor Creek, Leboeuf, McKean, Mill Creek, North East, Presque

Island Peninisula, Springfield, Summit, Venango, Washington, Waterford and Wayne in *Erie County.*

Ohio: Ashtabula, Austinburg, Conneaut, Denmark, Geneva, Harpersfield, Jefferson, Kingsville, Monroe, Pierpont, Plymouth, Saybrook and Sheffield in *Ashtabula County;* Cleveland, Dover, Euclid, Independence, Mayfield, Middleburg, Newburg, Rockport, Warrensville and West Park in *Cuyahoga County;* Berlin, Huron, Kelleys Island, Margaretta, Perkins, Portland, and Vermillion in *Erie County;* Chardon, Chester and Thompson in *Geauga County;* Concord, Kirtland, Leroy, Madison, Mentor, Painesville, Perry, and Willoughby in *Lake County;* Amherst, Avon, Avon Lake, Black River, Brownhelm, Elyria and Sheffield in *Lorain County;* Jerusalem, Oregon, Toledo and Washington in *Lucas County;* Allen, Bay, Benton, Carroll, Catawba Island, Clay, Danbury, Erie, Middle Bass Island, North Bass Island, Portage and South Bass Island in *Ottawa County;* Townsend in *Sandusky County;* Lake and Ross in *Wood County.*

Michigan: Bedford, Berlin, Erie, Exeter, Frenchtown, Ida, La Salle, Monroe and Whiteford in *Monroe County;* Brownstown, Detroit, Ecorse, Gratiot, Greenfield, Grosse Pointe, Hamtramck, Huron, Monguagon and Springwells in *Wayne County.*

The regulations of this quarantine order are subject to modification to include additional territory, if such is found infested and in general will be interpreted as conforming to, rather than as being at variance with, the regulations of the Federal Horticultural Board.

Quarantine Orders No. 1 relating to this insect, and issued September 20, 1918, and No. 3, issued June 1, 1920, are hereby revoked.

This order shall take effect June 1, 1923.

E. H. JENKINS,
Director, Connecticut Agricultural Experiment Station.

Approved:
CHAS. A. TEMPLETON,
Governor.

PREVALENCE OF ORIENTAL PEACH MOTH.

Laspeyresia molesta Busck

The reappearance of the Oriental peach moth in Connecticut in 1922 and 1923 has already been mentioned on page 232 of this Report. The first information regarding the presence of this pest in Connecticut was received in 1917, when specimens were sent to the Bureau of Entomology by Mr. C. C. Lawrence of the F. A. Bartlett Tree Expert Company of Stamford, and identified as the Oriental peach moth. Mr. Lawrence also sent material to this

Station, but it was badly crushed and could not be properly identified. In the absence of the writer, Mr. Quincy S. Lowry, then Assistant Entomologist, answered the letter and suggested that more material be sent for examination. Meanwhile the reply from Washington specifically identified the insect, and a short report of the pest was included in the Report of this Station for 1917, page 315. Beginning April 1, 1918, Mr. Ernest D. Brown was employed by the Federal Bureau of Entomology to search for this pest in Connecticut in order to ascertain its exact distribution. Mr. Brown worked in Connecticut for six months and found the larvae of this insect only in Stamford where it was discovered in 1917, although he found twig injury in each of the four southern or shore counties of the State. He did not find this injury far inland or in the northern counties, nor was he certain that it was wholly caused by *Laspeyresia molesta*, because the peach twig borer, *Anarsia lineatella* Zell., causes similar injury and is also present in the shore region of the State. An account of the Oriental peach moth with a report on the scouting done by Mr. Brown was published in the Report of this Station for 1918, page 298, and following this article in the same Report (page 306) is an account of the peach twig borer, *Anarsia lineatella*, giving its distribution in Connecticut based upon the collecting done by Mr. Brown.

In 1919 and 1920, visits were made to the locality in Stamford where larvae occurred in 1918, but no signs of this insect could be found. Injury caused by it was not observed anywhere in the State in 1921, though entomologists from this office traveled about the State and were on the lookout for it.

During the autumn of 1922, considerable twig injury was noticed in the southwestern corner of the State, which was thought to have been caused by the Oriental peach moth. In the summer of 1923, twig injury was noticed in a number of orchards, and later during the annual inspection of nurseries in August and September, twig injury was found on peach stock in a few of the nurseries in Fairfield County, and on some orchard trees near the nursery stock. Perhaps the most serious attack observed was in the peach orchards at Conyers Farm, Greenwich, which the writer visited in company with Dr. Garman on June 25. Many of the new shoots were brown and had been tunneled by the larvae, though in most of them no larvae could be found. During December, Mr. A. T. Henry informed the writer that he observed considerable twig injury in his orchard at Wallingford, and on January 8, 1924, Mr. Arthur J. Watrous of Meriden, brought to the Station several peach twigs which had been tunneled by this insect during the growing season of 1923. Recently reports have been received from the orchard of Elijah Rogers and Son of Southington, indicating that this insect has injured some twigs there.

The latter part of the summer the larvae were found in fruit at Conyers Farm, Greenwich, where the manager estimates that fully

50 per cent. of the fruit was injured by the larvae, causing a money loss of at least $5,000.00 in damage to crop, not to mention injury to reputation on account of having wormy fruit. The late varieties such as Hale, Elberta and Belle of Georgia were damaged more than those varieties ripening earlier in the season. A number of infested peaches were observed at the Station Farm, Mount Carmel, and Mr. Watrous also reported that he found infested peaches in his orchard in Meriden.

According to fruit growers and entomologists, this pest caused serious damage in 1923 in Pennsylvania and in New Jersey, where in some cases 80 per cent. of the late peaches were infested.

Though the larvae attack apples and other fruits in the Middle Atlantic States, only peaches have been found infested by it in Connecticut.

Summary of Life History.

The eggs of the first brood are probably laid the latter part of May or early in June on the under surface of the leaves. They are laid singly and hatch in four to seven days; the larvae go to the new shoots and tunnel in them, causing them to turn brown at the tips as is shown on Plate XVIII. They often leave one shoot and enter another, and this explains why injured empty shoots are so abundant in a badly infested orchard. It is not known how many generations occur in Connecticut, but in Maryland, Dr. Garman[1] found four generations, only about 26 days being required for the entire life cycle. Wood and Selkregg[2] found a partial fifth generation near Washington, D. C., but Stearns[3] found only four broods in Virginia. In Maryland the first two broods were fairly distinct, but the third and fourth overlapped so that it was hard to separate them. In New Jersey according to Dr. Peterson, the last three broods overlap.

As the season advances and the new growth hardens and becomes woody twigs, the larvae attack the fruit. In late summer the newly hatched larvae apparently go directly into the fruit, and often several larvae are found in one peach. The larva has the habit of biting into the tissues and laying aside the first few mouthfuls, then eating its way into the twig or fruit. For this reason the larvae cannot be controlled satisfactorily by applications of arsenical poisons.

The larval period averages about eleven days and the pupa stage lasts about ten days. When mature the larva eats out cavities in the sides of twigs or whatever surface is near at hand and suitable for the purpose, and there makes an inconspicuous cocoon. Those maturing late in the season usually enter crevices of the bark

[1] Bulletin 223, Maryland Agricultural Experiment Station, page 113, 1917.
[2] Journal of Agricultural Research, vol. XIII, page 63, 1918.
[3] Technical Bulletin 21, Virginia Agricultural Experiment Station, 1921.

at the base of the trunk or in similar situations higher up on the tree and are very difficult to detect. The hibernating larvae pupate in these cases in the spring, and the moths soon emerge to lay eggs for the first brood of larvae.

Altogether some 15 different parasites of the Oriental peach moth have been reared in the United States. Of these 12 belong to the Hymenoptera and three to the Diptera. In Dr. Garman's studies in Maryland[1] two important parasites were obtained. One, a Braconid, *Macrocentrus* sp., was reared in small numbers from the larvae, and the other, a Chalcidid, *Trichogramma minutum* Riley, parasitized about 80 per cent. of the eggs. Wood and Selkregg[2] recorded six primary parasites belonging to the Hymenoptera and one belonging to the Diptera.

Professor E. N. Cory, State Entomologist of Maryland, estimates that about 60 per cent. of the larvae and about 50 per cent. of the pupae are parasitized in Maryland. Stearns[3] reports that on the average only 20 per cent. of the larvae of the three summer broods were parasitized in Virginia in 1920, and fully 85 per cent. of the hibernating larvae came through successfully.

Control Measures.

The Oriental peach moth is a difficult pest to control. Many tests have been made with various liquids and gases to kill the over-wintering larvae in their cases, but these cocoons or cases are almost impenetrable, so the larvae for the most part pass through the treatment uninjured.

After pruning the orchard, it is advisable to burn all twigs for this may destroy some of the hibernating larvae.

Stearns[1] finds that spraying with nicotine solution diluted at the rate of one part in 500 parts of water, will kill the eggs in Virginia[4]. A caseinate spreader at the rate of two pounds in 50 gallons of mixture increased the effectiveness of the treatment. Only 4.7 per cent. of the untreated eggs failed to hatch, whereas from 75 to 85 per cent. were killed by the treatment.

The approximate periods of heaviest egg-laying in Virginia were from May 8 to 16 for the first brood, from May 31 to June 7 for the second brood, and from June 27 to 29 for the third brood and from August 1 to 10 for the fourth brood. The spray treatments should be given with reference to these dates. Egg-laying dates have not been ascertained for Connecticut.

[1] Bulletin 209, Maryland Agricultural Experiment Station, 1917.
[2] Journal of Agricultural Research, Vol. XIII, page 70, 1918.
[3] Journal of Economic Entomology, Vol. 14, page 337, 1921.
[4] Journal of Economic Entomology, Vol. 14, page 340, 1921.

THE LARCH LEAF-MINER OR CASE BEARER.

Coleophora laricella Hubn.

On June 4, Mr. H. W. Hicock, Assistant Forester, brought to the laboratory from the town of Canaan, branches of larch which had been attacked by the larch leaf-miner or case bearer, *Coleophora laricella* Hubn. The newly formed leaves had been mined and injured to such an extent that the foliage of the entire branch had a gray appearance and later turned brown. According to Mr. Hicock, the specimens came from a large swamp a mile or so in extent, and the trees were distinctly brown on the day of his visit. This swamp is situated near the road connecting Canaan with South Canaan. Injured foliage is shown on Plate XIX, a.

On June 7, larch received from New Canaan also showed the attacks of this insect. The writer noticed slight injury to larch trees on private grounds and in public parks in New Haven and various other parts of the State. Never before in recent years has this insect been so abundant in Connecticut.

The larch case bearer is a European insect and on the continent it has caused damage to the larch trees of the forests, particularly in Germany. When the larch was introduced into the British Isles, this case bearer soon appeared in England and Scotland. Later it made its appearance in America and probably was brought across the Atlantic on nursery stock. It has been reported from Canada and the northeastern United States.

Injury to the Trees.

The young larva is a leaf-miner at first and tunnels the distal half of the needle. It cleans out this hollow needle and then cuts it off at the base of the excavated portion and uses the latter as a case, carrying it about when feeding, and resting in it much like the cigar case bearer, *Coleophora fletcherella* Fern., and other case bearers. The appearance of this case is shown on Plate XIX, b. As the partly grown larvae pass the winter in these cases on the twigs, they are ready to resume feeding on the first leaves that are put out in the spring. Consequently when the larvae are abundant the leaves are eaten about as fast as they can grow, with the result that the trees look sickly and brown by the first of June, instead of green and vigorous. Even though more leaves are put out, they are mined later in the season. Thus severe attacks weaken the trees, and Dr. Patch[10] writes as follows: "The injured needles often continue to grow but the clusters are ragged and many of the needles brown and dry. Small larches in the vicinity of Bangor and Orono which have been subjected to an attack of at least three seasons, died this summer from no other apparent cause than the presence of great numbers of the case bearers which kept the needles eaten off. Many large larches infested by this insect look yellowish and unhealthy."

Life History and Habits.

The eggs are laid upon the leaves during the first part of June and on hatching, each larva bores directly through the bottom of its shell and into the tissues of the leaf, where it continues to burrow, usually tunneling out the distal half. It has the habit of packing its excrement into the burrow in the mined leaf. By September the leaf has been completely mined, and the larva being small and only partly grown, cuts off the distal portion of the leaf; then it cleans out the excrement from the basal portion and uses this for its winter case. Sometimes it goes into a new leaf and sometimes makes its case of old leaves. The inside of each case is lined with a thin layer of silk. The larvae continue to feed for three or four weeks after making their winter cases, then fasten them with silk to the branches and twigs where they remain throughout the winter, as shown on Plate XIX, b. The outer end of the case is closed with silk and somewhat contracted. Usually this migration to the twigs occurs in October, and they remain there for about six months.

On the approach of warm weather, usually in April, the larvae dislodge their cases from the branches and migrate to the buds, where they are ready to partake of their first meal after their long winter fast. As soon as the new leaves are of sufficient size they fasten their cases to them or use them to enlarge their cases. This is fully described by Herrick[3] who states that this is the period when the insect does its greatest amount of damage, for each larva may feed upon more than one leaf, and being larger, destroys more leaves than before hibernation. The larvae continue to live in these enlarged cases and pupate in them in May, attaching themselves at the base of short side branches and in the center of leaf whorls.

The pupa stage lasts from 14 to 20 days and the adult moths emerge the last of May and following. The moths are active during the day and when at rest, the wings are folded closely over the body, and the antennae are extended forward.

Apparently there is only one generation each year, as is usual with most other case bearers.

Description.

Egg.—Eggs though small are visible without a magnifying glass. They are reddish-brown in color, nearly hemispherical in shape with 12 to 14 radiating ridges extending down the sides from the apex.

Larva.—Length, about five mm. when fully grown, dark reddish-brown, head, thoracic and anal shields, black.

Adult.—Wing expanse about nine mm., silvery grayish-brown or ash-gray in color, both front and rear wings narrow and bear

long fringe, characteristic of the family Elachistidae to which this species belongs.

Natural Enemies.

Herrick[8] bred three species of parasites in New York but only in small numbers; these were identified only provisionally on account of a lack of material. One belonged in the genus *Pachyneuron*, one to the Pteromalidae, and one to the Tetrastichidae. He reports that nine parasites have been recorded from Europe.

Control Measures.

There is no practical method of controlling this insect in forests or large plantations, but on shade and ornamental trees and in small plantations on private estates where cost is not an important matter, some attempt at control is feasible.

The most extensive experiments of which we have record are those conducted by Professor G. W. Herrick[8] in Ithaca, New York, in 1911. Trees sprayed with lead arsenate April 25, and even given an additional treatment May 5, were just as badly injured as the trees not treated.

Home-made concentrated lime-sulphur, testing 29° Beaumé, was diluted at the rate of one to seven and the tree thoroughly coated with the mixture on April 7, before the buds had begun to swell and before the larvae had left their winter positions. This tree was badly infested. An examination on April 27 showed that the buds had started and that on unsprayed trees the larvae had moved to the leaves, but not one had moved on the sprayed tree. On May 5, many larvae were examined. Only two were found to be alive; the others were dead and shriveled. Consequently, in view of these tests, it seems advisable to spray shade and ornamental trees with lime-sulphur, as for scale, late in the spring just before the buds open.

Literature.

[1] Felt, E. P., Memoirs N. Y. State Museum, 8, page 170, 1905. (Life history and habits.)

[2] Fernald, H. T., Can. Ent., Vol. li, page 264, 1919. (Injured trees in Northampton, Mass., same spot where Hagen reported it in 1886. Describes egg and habits of young larva.)

[3] Fletcher, J., Report of the Entomologist and Botanist, Central Experimental Farms, page 191, 1905. (Brief account).

[4] Fletcher, J., Thirty-sixth Annual Report, Ontario Ent. Soc., page 90, 1905 (Reports insect in moderate numbers at Experimental Farm, Ottawa, Can., and believes this the first record for Canada.)

[5] Gibson, A., Forty-first Annual Report, Ontario Ent. Soc., page 14, 1910. (Reports insect not abundant at Ottawa until 1910.)

[6] Hagen, H. A., Canadian Entomologist, Vol. xviii, page 125, 1886. (Abundant on European larches at Northampton, Mass.)

[7] Herrick, Glenn W., Annals Ent. Soc. Am., iv, page 68, 1911. (Describes habits and partial life history: original observations, Ithaca, N. Y., 1910-1911.)

[8] Herrick, Glenn W., Cornell Agr. Expt. Station, Bulletin 322, 1912. (Complete life history, habits, natural enemies, control, bibliography.)

[9] Herrick, Glenn W., Journal of Economic Entomology, Vol. 5, page 172, 1912. (Treatment with lime-sulphur.)

[10] Patch, Edith M., Maine Agr. Expt. Station, Bulletin 134, page 218, 1906. (Brief account of habits and life history. Mentions death of trees.)

[11] Patch, Edith M., and Johannsen, O. A., Maine Agr. Expt. Station, Bulletin 195, page 239, 1912. (Mention as being abundant on American Larch in 1911.)

[12] Swaine, J. M., Forty-third Annual Report, Ontario Ent. Soc., page 88, 1912. (Mentioned as being abundant on European and American larches in Ottawa in 1912.)

[13] Theobald, F. V., Report on Economic Zoology, page 111, 1905. (Brief illustrated account.)

[14] Weiss, H. B., Ent. News, Vol. xxvii, page 424, 1916. (Not extensively distributed in N. J. Probably introduced on nursery stock.)

THE ASIATIC BEETLE.

Anomala orientalis Waterhouse.

In the Report of this Station for 1922, page 345, is a brief account of this new pest which has apparently become established in Connecticut. Since this note was prepared for publication, further developments have occurred which warrant further mention here of the undesirability of this insect.

Late in the fall of 1922, one of my neighbors, Mr. H. M. Bowman, complained to me that white grubs were injuring his lawn at 228 Alden Avenue, and on November 2, I visited his place and collected a few specimens. These grubs had killed the grass in a patch perhaps eight by ten feet in the front lawn near the sidewalk. By digging in the soil, we found some of the grubs, though Mr. Bowman stated that they had recently descended and were much nearer the surface a short time before. Evidently they had gone down for protection during the winter. These grubs were quite active and though varying considerably in size, all were rather small. Otherwise they looked like ordinary white grubs, and at the time we took them to be the larvae of May or June beetles (*Phyllophaga* sp.) These grubs all died probably having injured each other with their mandibles, as we afterward learned they are apt to do when confined together with little soil. The grubs are shown on Plate XX, b.

The next spring other residents of the neighborhood complained of similar injury to lawns. Mr. Robert S. Scobie, corner of Central and Edgewood Avenues, particularly had been troubled by them and had reseeded his lawn, only to have the new grass also eaten by the grubs. Mr. William E. Woodmansee and Mr. Clarence M. Blair of Edgewood Avenue had also gone through similar experiences. An injured lawn is shown on Plate XX, c.

Mr. Scobie accommodated us on May 17 by collecting a considerable number of grubs with a good supply of dirt. These were promptly separated so that they could not injure each other, by putting only a few larvae in each of several cages and supplying them with plenty of food and soil. On July 24, adult beetles emerged and proved to be *Anomala orientalis*. Prior to the emergence of these beetles, specimens of the larvae were sent to Professor John J. Davis, Agricultural Experiment Station, La-Fayette, Indiana, who had formerly been in charge of the Japanese Beetle Laboratory at Riverton, New Jersey, and prior to that had made a study of white grubs and various larvae of the beetle family Scarabaeidae. Professor Davis replied that he had sent his collection of larvae to Washington and was therefore unable to identify our material. He therefore forwarded it to Washington and in due time a report was received stating that it had been examined by Dr. A. Boving and identified provisionally as *Anomala orientalis*. Of the reared material, some specimens are light brown with very faint markings and some are black, as is the case with the native *Anomala lucicola* Fabr. Between these two extremes there are all gradations. This variation is shown on Plate XX, a.

More material was collected in the field in 1923. The adults do not fly but are found in the grass and weeds near the ground or crawling up the stems. This habit retards the dissemination of the pest and simplifies materially the problem of control. Messrs. Zappe and Garman treated small areas of infested soil in the lawns of Mr. Woodmansee with calcium cyanide compound, carbon disulphide emulsion and some other materials. The first killed the larvae and also the grass and weeds. The other materials in the proportions used were not effective in destroying the larvae.

No very thorough survey has yet been made to ascertain the present distribution of the pest. The preliminary survey shows that the injured lawns are all within five or six city squares or blocks, but as a certain number of larvae may be present per square yard without injuring the grass above ground, the distribution is probably much greater than indicated. It would be necessary to dig through the turf in thousands of places to ascertain its real distribution. Moreover as this infestation apparently was caused by nursery stock being imported with balls of earth from Japan, before the prohibition of such shipments by the Federal Horticultural Board, there is also a strong probability that this insect has likewise been sent out from the nursery to other points, perhaps nearby or far distant. This nursery has now been moved to Woodmont some six miles distant, and possibly the insect has been carried there also. The ground where the nursery formerly stood has all been sold for building lots and residences have been built upon it. In excavating for cellars and in grading, the upper soil has nearly all been moved, and this must have had some effect on the larvae in the soil. The lawns most seriously injured are

those across the street (Edgewood Avenue) from that part of the nursery where the adult beetles were first collected in 1920.

The parasite, *Scolia manilae* Ashm., which was so successful in reducing the infestation of *Anomala orientalis* in Hawaii a few years ago, has been imported into New Jersey to be used in controlling the Japanese beetle, *Popillia japonica*, but does not survive the winters there. Consequently we cannot hope for much help from this insect in controlling the infestation of *Anomala orientalis* in Connecticut, but there is a possibility that some of our native species of *Scolia* or *Tiphia* may attack the grubs.

SWARMS OF APHIDS.

During the season there were two separate swarms of aphids, one in June and the other in September, both of which should be recorded here. A similar swarm has been mentioned in the Report of this Station for 1919, page 203.

The aphids were so abundant and noticeable in and about New Haven, Bridgeport and Waterbury in June, 1923, that the newspapers printed notes regarding the matter. The following account of the June flight was published in the Journal of Economic Entomology, Vol. 16, page 395, August, 1923:

Swarms of Aphids: During the week ending June 9, newspapers and telephone inquiries reported that swarms of aphids were present in the cities of Meriden and Waterbury, Conn., and on June 8, specimens were received from Waterbury. On June 8, Mr. Zappe collected specimens at his home, Mount Carmel, where they were so abundant in the air that his little daughter said to him: "Daddy, it's snowing". During the week ending June 16, similar swarms of aphids appeared in the center of the city of New Haven, and the writer observed them on Elm Street on the afternoon of June 16. The tops of automobiles and clothes were literally covered with aphids and pedestrians were brushing them from their faces. Mr. Rogers of this Department states that in Bridgeport swarms of aphids have been present for three weeks, and one day in the city in catching a butterfly he also caught two or three hundred of these aphids in the net. Even at the date of this writing (July 3) aphids have not all disappeared in New Haven, and this morning Mr. Rogers ran into a swarm on Winchester Avenue. It is not certain that all of these aphids were of the same species, but those examined seemed to be identical and material submitted to Dr. A. C. Baker of the Bureau of Entomology has been identified as *Euceraphis deducta* Baker, a species described from Maine in 1917 (Journal of Economic Entomology, Vol. X, page 427). Birch is the host of this species and the swarms probably came from *Betula populifolia*, which is abundant around all of these Connecticut cities. In 1919, I recorded the presence of swarms of *Calaphis betulaecolens* Fitch

(see Journal of Economic Entomology, Vol. 12, page 351) in New Haven, Conn., and at first I supposed the swarms of the present season were of that species. A microscopic examination, however, showed them to be different. Dr. Baker writes that "it is very interesting that this recently described species should become so abundant".

This species, *Euceraphis deducta* Baker, had somewhat the aspect of a woolly aphid. That is, each individual bore some wax secretion in the nature of white filaments.

From September 19 to 25, aphids were again swarming in the streets of New Haven, and it was several days or perhaps weeks before they entirely disappeared. Specimens collected showed this to be *Calaphis betulaecolens* Fitch, a species devoid of the white wax filaments, and the same species observed in the city in 1919.

Both of these species live upon the leaves of birch trees, and it is not known whether they have alternate hosts, but perhaps like many other kinds of aphids, they were migrating to other host plants, which explains their presence in such number in the center of large cities. Birch trees are common on the uncultivated land around the outskirts of nearly all cities of Connecticut. The species of the September swarm, *Calaphis betulaecolens* Fitch, is also recorded from linden (*Tilia*) but evidently its full life history has not been determined.

MOSQUITOES AND HUMAN WELFARE.

Mosquitoes have been known and recognized as a pest since the earliest times. Writers have mentioned them; armies have been attacked by their hordes; large military and civic operations have been abandoned because of the great abundance of mosquitoes. Today mosquitoes occur throughout the world, from the tropics to the polar regions; all countries and all climates have been preempted by them and all races have been attacked by them. Not only do they attack persons, but also the larger animals, blood being necessary for the development of their eggs.

Certain kinds of mosquitoes through their bites transmit yellow fever, other kinds carry malaria and in no other way can these diseases be communicated from one person to another, except possibly by direct inoculation.

All kinds of mosquitoes annoy mankind, prevent property development, and therefore cause a tremendous economic loss to community, state and nation. Moreover, their abundance is wholly unnecessary.

Where Do Mosquitoes Breed?

Only in stagnant water. Until they reach the winged or adult stage, they can live only in fairly still water, where they are able to

obtain air at the surface. The belief of many persons that mosquitoes breed in grass, shrubbery and vines, is wholly false, though the pests hide and rest in such places. Water is just as essential for the wrigglers (larvae and pupae) as it is for trout or codfish, and if there were no standing water, there would be no mosquito nuisance. Permanent and deep pools and streams are usually stocked with fish and do not breed mosquitoes, because the fish will eat the wrigglers, should any hatch there. Rain water pools, barrels, buckets, tin cans, bottles and clogged ditches and gutters are common breeding places for fresh water mosquitoes, and the

Figure 11. Section of rain barrel showing eggs, larvae and adults of the rain barrel mosquito.

shallow depressions on the salt marsh are typical breeding places for salt marsh mosquitoes.

Only the Females Bite and Sing.

Male mosquitoes are very puny creatures and are not able to puncture the human skin. They live only a short time, and make no singing or humming noise. The common sound known as the "song" of mosquitoes is made by the females which are also responsible for all the mosquito bites. They bite in order to obtain blood, without which they are unable to develop eggs.

Life History of Mosquitoes.

Most mosquitoes lay their eggs on the surface of the water, either singly or in raft-like masses which float upon the surface. On hatching, each larva drops into the water and during its larval existence swims about with a jerky motion, most of the time holding its head downward. It has a large head with a tube or siphon at the tail, and every two minutes or so it comes to the surface and inhales some fresh air through this siphon. It feeds upon the minute particles of organic matter in the water, from six days to three weeks, depending upon the temperature, when it

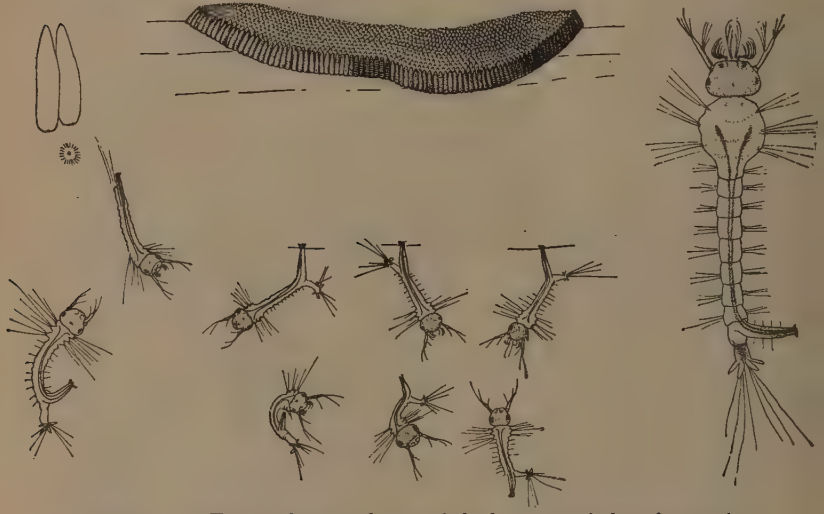

Figure 12. Eggs and young larvae of the house or rain barrel mosquito, *Culex pipiens*, Linn. All enlarged. (After Howard, Bulletin 25, Bureau of Entomology, U. S. Department of Agriculture.)

transforms to a peculiar hunchback pupa. Breathing is now done through two siphons on the thorax instead of one at the tail. In about two days the skin cracks open along the back, and the adult winged mosquito emerges, and after resting on the old shell and drying its wings, soon flies away. Only about a week is necessary for a mosquito to develop from egg to adult in hot weather. The stages in the life of a mosquito are (1) egg; (2) larva; (3) pupa; (4) adult.

Flight of Mosquitoes.

With the exception of the salt marsh mosquitoes, a few hundred feet is the extent of the distance traveled by most mosquitoes.

Salt marsh mosquitoes (two species) migrate or are wind-borne for many miles. In New Jersey they have been found at least thirty miles from their breeding place, and in Connecticut eighteen miles. During strong winds they seek shelter, but in warm foggy weather, gentle breezes may aid them in going inland for several miles. After obtaining blood, they return to the salt marsh to deposit their eggs.

Where intensive breeding takes place in polluted streams, the

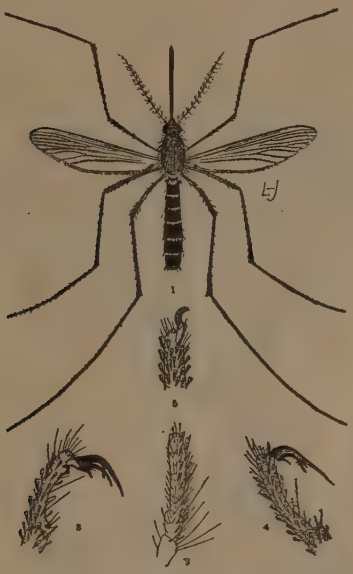

Figure 13. The house or rain-barrel mosquito, *Culex pipiens* Linn.: 1. adult female; 2. palpus; 3. anterior, 4. middle, 5. posterior claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

house mosquito has been found a mile from its breeding place, but usually this species does not go more than one-fourth that distance.

Different Kinds of Mosquitoes.

There are known to be about 500 different kinds of mosquitoes throughout the world; about 100 kinds occur in the United States. Nearly 50 species have been recorded from the State of New York, and about 25 kinds occur in Connecticut. Of this number, only five kinds need here be considered.

RAIN BARREL OR HOUSE MOSQUITO 1. *Culex pipiens* SPOTTED OR MALARIAL MOSQUITO (2 species) 2. *Anopheles punctipennis* 3. *Anopheles quadrimaculatus*	Breed in fresh water; fly only short distances; enter houses and bite after dark.
SALT MARSH OR MIGRATORY MOSQUITOES 4. Brown salt marsh mosquito, *Aedes cantator* 5. White-banded salt marsh mosquito, *Aedes sollicitans*	Breed in brackish water; fly long distances; do not enter houses, and bite promptly in the day time.

Figure 14. The banded salt marsh mosquito, *Culex sollicitans* Walk.: 1. adult female; 2. palpus; 3. anterior, 4. median and 5. posterior claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

How to Distinguish Malarial from Other Mosquitoes.

Malarial mosquitoes have spotted wings, the beak and body are nearly in a straight line, and it "stands on its head".

Other mosquitoes do not have spotted wings, the beak makes a greater angle with the axis of the body and the body is parallel with the surface upon which the mosquito stands or rests.

Larvae or wrigglers in the water may also be distinguished by their different shapes. Malarial species are green or gray, lie horizontally at the surface of the water, and move to other posi-

tions on the surface without dropping downward into the water. Moreover their bodies are nearly as thick at the tail as through the head and the breathing tube or siphon is very short. Other mosquito larvae hold their heads downward when breathing at the surface and if disturbed drop downward into the water. The head and thorax are large, from which the body tapers toward the tail end, which is furnished with a long siphon. The color is usually dirty white or gray.

The Mosquito Plague of Connecticut.

The great mosquito plague of Connecticut is caused by the abundance of only a few kinds of mosquitoes. A few years ago

Figure 15. Larvae of *Culex* and *Anopheles*, showing the characteristic position of each at the surface of the water. 1. *Anopheles;* 2. *Culex cantator.*

in the southern half of the State, the salt marsh mosquitoes were the most prominent, and this is true today except in certain sections where the salt marshes have been ditched. In these ditched sections and in all other parts of the State, the rain barrel or house mosquito is the chief offender.

At present about one-third of all the salt marsh areas of Connecticut have been ditched and the ditches have been maintained in working condition. There still remains some 12,000 to 14,000 acres of salt marsh to be ditched before we shall be rid of the nuisance of migratory or day-biting mosquitoes.

The rain barrel mosquito is local in its distribution and breeds in rain water pools, receptacles, polluted streams, etc. A single bucket of water will furnish enough mosquitoes to infest the premises.

Control or Relief Measures.

Rain Barrel Mosquitoes.—Fill or drain all depressions which may catch or hold water during the summer months. See that no receptacles collect and hold rain water about the premises. Small swamp areas and deep depressions which cannot be filled or drained except at great expense, may be dredged to form permanent pools and stocked with fish.

Malarial Mosquitoes.—See that edges of springs and streams are cleared of vegetation and have steep banks. Screen all houses, and particularly all persons having malaria.

Salt Marsh Mosquitoes.—Cut narrow parallel ditches through the salt marsh, from the hard land to the central creek or outlet. These usually need to be about 150 feet apart, but the distance depends upon the character of the marsh and the amount of breeding. Special work, such as building dikes, tide gates and deepening major outlets are necessary in some cases. In general these narrow ditches cost about ten dollars per acre. A slight expense each year must be incurred to examine the ditches and remove obstructions.

Oiling.

Wherever mosquitoes are found breeding in water, it is possible to kill all of the wrigglers by spreading a film of oil on the surface. This prevents their access to the air and they suffocate. The oil also penetrates their respiratory system and injures their tissues. Kerosene is the cheapest oil for this purpose which is readily and universally available. Light fuel oil may be obtained from oil stations in the larger cities. Old cylinder oil from garages may be used if mixed with an equal quantity of kerosene. A spray pump is the common agency for spreading the oil, though in small pools a sprinkling can or saturated sawdust may be used. One fluid ounce of kerosene will cover about 15 square feet of surface.

Oiling is only a temporary expedient and should not be practiced except in special cases. On the salt marsh in a single season it would cost about one-fourth as much to oil the pools as it would to cut ditches, but the ditches would last for years and make further oiling unnecessary.

Mosquito Enemies.

Fish feed upon mosquito wrigglers, particularly small fish such as "minnows" and "killies" which eat animal food and feed near the surface. By cleaning the banks of deep pools and sluggish streams, and stocking with these fish no mosquitoes will breed there. There are also many aquatic insects which devour mosquito larvae.

Individual and Community Effort.

The control of the fresh water species like the malarial and rain barrel mosquitoes which fly only short distances, is a matter for each individual resident and property owner, though far more will be accomplished if all individuals work together toward the same end. This is largely a problem of house to house inspection, with control measures practiced where needed.

It is a commendable line of activity for local civic and village improvement associations, boy and girl scouts and women's clubs

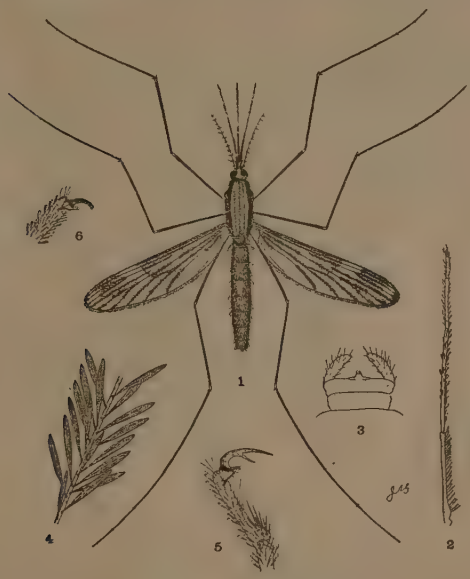

Figure 16. A malarial mosquito, *Anopheles punctipennis*. 1. adult female; 2. palpus; 3. genitalia; 4. part of wing vein, showing scales; 5. anterior, and 6. middle claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

to co-operate with the Experiment Station. Surveys can be made in each neighborhood to ascertain where mosquitoes are breeding. When mosquitoes are especially troublesome, specimens should be collected and sent to the Station for identification. There is already legislation (Section 2408 of the Revised Statutes) declaring accumulations of water in which mosquitoes breed a public nuisance, and authorizing the health officer to order them abolished.

Salt Marsh Mosquito Problem A State-Wide Matter.

As the mosquitoes of the salt marsh are migratory and often fly long distances, isolated individual or even community effort counts for but little in controlling the plague. Even efforts involving entire townships, though commendable, do not bring the maximum degree of relief unless other towns also act in the matter. Some towns will take no action, either on account of cost or because the people do not expect effective results. Consequently when left entirely to local initiative, the work is apt to be spotted and disconnected if any is done at all. Thus the salt marsh area of Connecticut has been ditched from the New York line as far eastward as Westport, which is still unditched, Fairfield, Bridgeport, a part of Stratford, West Haven, New Haven, a part of East Haven, from Branford River to Hammonasset River with small areas in Old Saybrook and Groton, have all been ditched. Some of the areas mentioned above are not yet under State supervision. In order to make the work continuous and to obtain the full benefit of the ditching already done, the towns of Westport, Stratford, Milford, parts of East Haven and Branford, Clinton, and all towns to the eastward should have their salt marshes ditched.

Legislation has already been enacted (see Section 2409 of the Revised Statutes and Chapter 68, Public Acts of 1923) providing for, and authorizing the Director of the Connecticut Agricultural Experiment Station to ditch salt and fresh marshes and maintain the same. He can make investigations and furnish estimates, supervision, etc., upon request. In case the ditching work has been accomplished, he will inspect it upon request. If it merits his approval, he will accept it officially and see that it is properly maintained at State expense.

Benefits of Mosquito Control.

Health.—Eradication of malaria bearing mosquitoes will prevent the spread of malaria in any community, town or state. Other native species of mosquitoes, though not known to carry disease-causing organisms, are a detriment to health because their bites sometimes become infected, and because of the irritating effect on the nervous system.

Comfort.—No person can be comfortable when attacked by hordes of mosquitoes. Whole regions have been developed, neglected or abandoned because of the absence or abundance of mosquitoes.

Increased Property Values.—Wherever the mosquito nuisance has been controlled, substantial increases in property values have followed. This is a logical result of making building sites more desirable because people can be more comfortable there. The increased population means increased business, increased trans-

portation, and better yet, increased taxes for the town and for the State.

Increased Crops.—Wherever salt or fresh marshes are ditched the quality of the vegetation is improved; it makes better hay. The quantity is also increased, giving a greater yield. It has been shown in New Jersey that by ditching the yield of salt marsh hay has been increased from two to twenty fold.

Send Specimens For Identification.

If anyone is interested in the mosquito problem of his locality and wishes to know whether malarial mosquitoes are present, he is requested to collect adult mosquitoes and send them for identification to the Connecticut Agricultural Experiment Station, New Haven, Conn. They should be mailed in a pill box or vial, well packed so that they will not become crushed in transit. Mosquitoes which are badly worn or broken cannot readily be identified, but if the material is fresh and plentiful (10 to 20 specimens) there should be no difficulty in identifying the species.

MOSQUITO CONTROL WORK.

Season of 1923.

By R. C. Botsford.

Legislation.

The State law providing for the elimination of mosquitoes, Chapter 21, Public Acts of 1919 (see 1919 Report, Connecticut State Entomologist, page 194) was amended by the 1923 Legislature to read as follows:

Chapter 68.

Section 1. Section 2409 of the general statutes is amended to read as follows: The director of the Connecticut Agricultural Experiment Station may make rules and orders concerning the elimination of mosquitoes and mosquito breeding places, and he or his agent may enter upon any swamp, marsh or land to ascertain if mosquitoes breed thereon or to survey, drain fill or otherwise treat, or make any excavation or structure necessary to eliminate mosquito breeding on, such land. Whenever funds have been provided by voluntary contribution or by appropriation by the state for the elimination of mosquitoes or mosquito breeding places said director may order the execution of such work upon notice as herein provided. At least thirty days before commencing such work, said director shall file a copy of such order, with a description of the place or area affected and a statement of the proposed plan thereof, in the town clerk's office in each town in which such place or area is located. Said director shall publish a copy of such order once each week for two successive weeks in some newspaper having a circulation in the town or towns in which such place or area is situated, and shall mail a copy of such notice, postage prepaid, by registered mail, addressed to each record owner of land whose name and address may be ascertained by a reasonable inquiry from the assessors of the town in which such land is situated. Said

director may, and upon application of any person affected by such order or plan, within thirty days after such publication, shall, assess damages sustained by the owner of any such land. Such assessment shall be filed by said director with the clerk of the superior court of the county within which the land affected is located, and said clerk shall give notice of such assessment to each such property owner, by mailing to him a copy of such assessment, postage prepaid. Any person claiming to be aggrieved because of such order or proposed plan or such assessment may, within ten days after notice, apply to the superior court in the county in which such land is situated, or any judge thereof, for relief, and said court or such judge may, after notice to said director and parties applying for relief, and hearing thereon, make any proper order concerning such order or proposed plan, or make a reassessment of damages. Said court or judge may view the land claimed to be affected by such order or plan and may take any evidence in his opinion material. The order, plan and assessment as hereinbefore provided for shall be conclusive upon all parties affected thereby, and the state treasurer shall pay to any such owner the damages assessed by said director or by said court or judge, as the case may be, upon certification of the amount by the clerk of said court. The pendency of any application for the assessment of damages shall not prevent or delay the execution of the work for the elimination of mosquitoes or mosquito breeding. Upon the completion, to the satisfaction of said director, of any such work, said director shall certify to the comptroller, with proper vouchers, the amount of such costs, and the comptroller shall draw his order on the treasurer for the payment of the same.

Sec. 2. Section 2410 of the general statutes, as amended by chapter 21 of the public acts of 1919, is amended to read as follows: Whenever any swamp, marsh or other land has been drained to the approval of the director of the Connecticut Agricultural Experiment Station, he shall keep the same in repair and free from obstruction, and construct or repair tide gates or otherwise treat such areas so as to make such work effective. Said director may appoint one or more deputies to supervise the work done under the provisions of this and the preceding section, who may exercise the authority granted to such director. The expenses of said director and said deputies in carrying out the provisions of this and the preceding section shall be paid from funds provided by voluntary contributions or from funds appropriated by the state for such purpose. The comptroller may advance to said director such amounts within the appropriations therefor, as are necessary to meet the current expenses for labor authorized under the provisions of this and the preceding section. Any person obstructing the work of examining, surveying or ditching or otherwise treating such mosquito breeding areas, or obstructing any ditch, canal or drain, or the natural outlet of any marsh forming mosquito breeding areas, shall be fined not more than one hundred dollars or imprisoned not more than ninety days or both.

Approved April 17, 1923.

Under the old law, the cost of maintenance, not to exceed one dollar per acre in any one town, was paid by the State, and the town wherein the work was done reimbursed the State for three-fourths of the amount so expended for maintenance. This added about $2,500.00 to $3,000.00 to the regular appropriation.

The new law, which went into effect on July 1, 1923, provides that the State pay all expense of maintaining drained areas which have been approved by the Director. The sum of $12,000.00 was appropriated for mosquito elimination work during the two-year period from July 1, 1923 to June 30, 1925.

The total expenditure for the year was $8,944.87. Owing to the change in law this year, a detailed account of the above would be

too bulky to be included in this report. The Director's Report for 1923 covers the first half of the year, and his 1924 Report will include the remainder.

General Conditions.

Mr. S. T. Sealy, who has served as Deputy in Charge of the work for three years, resigned to take effect March 31, 1923, and Mr. B. H. Walden was placed in charge of this work temporarily. On July 1, 1923, Director Slate appointed the writer Deputy in Charge.

The general spring inspection showed much of the drainage work in poor condition. Many of the culverts at beach outlets were badly damaged and in some cases completely destroyed. The tide gates and dikes were found to be in fair condition, with the exception of the Stony Creek dike, which was badly damaged.

Although it is unlawful for any person to interfere with the free flow of water in any drainage system under State maintenance, the usual number of obstructions in ditches were found, caused by the careless dumping of rubbish, and by farmers and trappers. In many cases the outlets of ditches became clogged by a thick growth of sedge grass. The result is that some sections of the ditch tend to fill with mud, upon which grass takes root, the water is held back upon the marsh and breeding pools form. Thus in one season a neglected ditch may become a source of mosquito breeding.

For recutting ditches, a simple trimming tool was made consisting of two hay knives bolted to a light brace which held the blades in a parallel position the width of a ditch. A longer handle was attached for ease in operating. With this tool (shown on Plate XXI, a) both sides of a grass grown ditch could be trimmed at the same time. Several thousand feet of ditches were reclaimed this fall.

The absence of rain was a factor in preventing marsh pool breeding, although in some localities the continuous high tides offset this advantage. In every case where breeding was discovered, measures were taken to destroy the larvae and make their recurrence impossible.

The success of the anti-mosquito work this season is largely due to individuals, associations and towns contributing money and reporting mosquito infestations, also the co-operation of city departments, town officials, the board of health and others.

The Work By Towns.

NEW HAVEN.

The salt marsh mosquito breeding in this section was confined to an area in the Quinnipiac marsh north of Little River, the tide water being held back in about 80 acres of marsh by stones under Little River bridge at Middletown Avenue. The Bridge Department removed some of the stones and the water was lowered about ten inches. More stones will be removed next year.

No breeding was observed on the West River meadows. The harbor marsh and the ditched sections at Morris Creek were also kept free. Scattered breeding occurred at Fort Hale by reason of grass grown ditches and the high tide gate sill at the moat outlet. Upon request, the Park Department lowered the tide gate sill about seven inches. All of the ditches south of the Fort Hale road were recut this fall.

There was practically no mosquito breeding in other park property this season, although some *Anopheles* (malaria mosquitoes) larvae were discovered in Edgewood Park. The drainage system being installed at Beaver Swamp by the Park Department has eliminated the prolific *Anopheles* breeding there. One pool in that locality breeding *Culex* (house mosquito) was oiled. Many possible breeding places in the city parks have been filled.

WEST HAVEN.

Before work could be started this season a large brood of mosquitoes developed in the Old Field Creek marsh and infested the town. The tide gate at Beach Street was found badly damaged and blocked with a quantity of large stones. A large sand bar beyond the gate had completely closed the outlet to the harbor. The marsh above was flooded and much sewage was present. These conditions were ideal for mosquito breeding. Much labor was expended in this area keeping the outlet open, the tide gate in working order, and cleaning and recutting grass grown and mud filled ditches. In spite of our efforts, which were hampered by lack of funds, some scattered breeding was present throughout the season. The drainage system in the marsh is difficult to maintain on account of the frequent closing of the outlet by shifting sand. This results in the ditches filling with mud which in turn quickly grasses over. The outlet from the gate to the harbor should be deepened about two feet and a sluiceway installed to extend beyond the sand bar. A new tide gate is required and the creek should be dredged from Beach Street to Peck Avenue.

The other marshes in this section were kept free from breeding.

EAST HAVEN.

The two ditched areas of salt marsh in this section under State maintenance, one at Morris Creek and one at Silver Sands east of Caroline Creek, were kept free of mosquito breeding during the whole season. There was considerable breeding in the marsh near West Silver Sands not under State maintenance. These mosquitoes were troublesome periodically throughout the treated as well as the untreated areas.

The Town of East Haven has installed 978 feet of 18-inch corrugated iron pipe in Cosey Beach Avenue, extending from the property of Philip Smith to an extension of Caroline Creek.

The Connecticut Company has completed the filling of its marsh area at Momauguin including the ditch between this property and Philip Smith's which formerly carried the drainage water from a large swamp north of the road leading to South End. Adequate means of handling this water are to be provided by the property owners and connected to the 18 inch pipe laid by the town.

The State Rifle Range was inspected on June 12. Owing to the lack of rain nearly all of the depressions that hold water in an ordinary season were dry, and no mosquito larvae were found. There were many fresh water mosquitoes present which had emerged earlier in the season. These were especially abundant in the wooded or brush areas. In the open spaces many salt marsh mosquitoes were observed which had undoubtedly come from the undrained salt marshes in the southern part of the town.

BRANFORD.

Labor for maintenance of this section was furnished by Mr. L. E. Rice. In some cases mosquitoes got on the wing before the areas could be treated. At Sunset Beach the natural outlet was found to be closed by large rocks which were removed at considerable cost. The Sybil Creek marsh north of the tide gates on the Indian Neck road was covered with water. This situation was partly corrected by lowering the bed of the creek under the road bridge. Many of the ditches in this area were filled with soft mud and grassed over, creating breeding pools on the marsh surface and in ditches. Several thousand feet of ditches were recut and deepened. No breeding was discovered on other marshes in this section.

The large marsh at Stony Creek has been flooded all the season due to a broken dike. Presumably there was some breeding on this marsh which accounts for some complaints of mosquitoes in Stony Creek Center. State funds were insufficient to repair this dike, but the meadow owners and some public spirited summer residents contributed generously and the dike was repaired. The ditches in this marsh are badly damaged, and it is doubtful if they can be reconditioned next spring in time to prevent early breeding. The tide gates at Hubbard's Bridge on the Branford River need repairs.

GUILFORD.

Maintenance work was started promptly in this section by Mr. Frank Blatchley and continued throughout the season. No breeding was discovered and no complaints received.

Several hundred feet of ditches were recut in the vicinity of Shell Beach and a bad leak under the tide gate sill at Great Harbor stopped. The labor was furnished by one of the summer residents. The area of this section is too great to be properly maintained by one man, and some of the ditches have become grass grown and

filled with mud. This condition will produce breeding pools in a wet season.

MADISON.

The only serious outbreak of mosquitoes in this section occurred early at the Hammonasset State Park. These were troublesome periodically throughout the first half of the summer. Oil and labor were furnished by the State Park Commission and millions of larvae in clogged ditches and marsh pools were destroyed. As soon as the offending ditches were cleaned and graded, no further breeding occurred. Plans are under way to carry on a vigorous anti-mosquito campaign at Hammonasset next year in co-operation with the State Park and Forest Commission.

No breeding was discovered in other marsh areas of this section, and no complaints were received. Much additional labor will be required to recondition some of the ditches, which during a normally wet season will no doubt become a source of mosquito breeding.

The most important part of mosquito control work in this section consists of keeping the several beach outlets open. This was accomplished during the entire season by Mr. Russell Bartlett and but little time remained to patrol the marsh sections properly. This section is too large for one man to maintain at this time owing to gradual deterioration of the drainage works.

The culverts at the beach outlets have been damaged or totally destroyed at some previous time by storms. When these are replaced the labor expended in opening these outlets every few days will go far in reconditioning and maintaining the ditches in the potential areas.

WESTBROOK.

This year the Town of Westbrook appropriated $1,000.00 to start mosquito elimination work in this section. This amount has been increased by generous contributions from a few public spirited citizens. The money was turned over to the Connecticut Agricultural Experiment Station, under whose supervision the ditching of the marshes will proceed.

The long search for suitable labor delayed the start of ditching until December 12. Work was begun on December 12 in Rushy Meadow at Middle Beach. In order to remove the surface water from this flooded and soggy area, about 1,770 feet of old ditches were first recut and deepened. The old ditches were not sufficient to remove all of the pools and 756 feet of new ten inch ditches were cut. Later these ditches will be deepened as required. The outlet of this marsh will require the installation of a 100 foot culvert to carry the water beyond the point of moving sand.

On the small marsh east of the property owned by Mr. Thomas Fisk, 441 feet of old ditches were recut and 510 feet of new ditches dug. The creek bed was widened and graded. A culvert will be required here as at Middle Beach. At the athletic field, 681 feet of old ditches were recut and 291 feet of new ditches dug. A total of 5,112 lineal feet of ditching was installed this year, much of which will require deepening to secure proper drainage.

Ditching was begun on the Broad Creek marsh and on the Lewis marsh south of the railroad track. All the new ditches in this section are being cut with hay knives, using a plank ten inches wide as a guide for cutting the sides of the ditch. The sods are pulled out with potato hooks and a satisfactory ditch is obtained after the bottom is graded.

The drainage work of Rushy Meadow and the Fisk marsh will be completed early next season if no further difficulties develop. These two marshes were found to be the most poorly drained salt marsh areas in Westbrook. They will no doubt prove to be the most costly to drain per acre and the most costly to maintain. As soon as the drainage of an area is completed and approved by the Director of the Connecticut Agricultural Experiment Station, the drainage works of that area will be maintained at State expense.

The other Westbrook marshes are dotted with stagnant pools and it is doubtful if much relief from mosquitoes will be afforded by the present expenditure.

OLD SAYBROOK.

A small ditched marsh area at Fenwick under private maintenance was inspected this fall, but owing to the high tide at that time the exact condition of the ditches could not be determined accurately.

GROTON.

The ditched area at Groton Long Point under State maintenance was thoroughly patrolled. On account of the foot bridge over the marsh outlet having been washed away, large stones had been rolled in for crossing. This interfered with the free movement of water and the stones were removed each trip. A road culvert was found closed due to careless dumping of rubbish, and some breeding resulted in the flooded area. Some of the ditches will be recut next season.

FAIRFIELD.

The drained salt marsh areas in this section under State maintenance were kept in good condition throughout the season by Mr. Nicholas Matiuck, with an average crew of two men. Nine hundred gallons of light fuel oil were purchased from the Standard Oil Com-

pany by contract. Breeding places in salt marshes and especially in the fresh water areas which could not be otherwise treated were oiled throughout the season. The breeding of salt marsh mosquitoes has been reduced to a minimum.

The fresh water problem of this section is under the immediate supervision of Dr. V. Havard, Secretary of the Fairfield Improvement Association, with Nicholas Matiuck in charge of the field work.

In 1922, a survey of the fresh water breeding places was made in this section including an estimate of the amount of labor and material required for treatment. Much public interest was aroused and generous contributions were received. During 1922, $1,081.94 was spent by the Association to treat these fresh water areas. All of this fresh water work was instigated and carried out by the Fairfield Improvement Association, to which great credit is due. The oil and the services of Nicholas Matiuck were contributed by the State.

In 1923, the Town of Fairfield appropriated $2,000.00 to carry on the work. The anti-mosquito activities in Fairfield have proven very successful and other towns are recommended to follow its example.

STAMFORD.

The salt marshes in this section were carefully patrolled by Nicholas Matiuck with an average crew of two men. The ditches were kept open and marshes were properly drained the whole season.

The City of Stamford continued its treatment of the fresh water areas.

MISCELLANEOUS INSECT NOTES.

Swarms of Butterflies.—On August 25, specimens of the milkweed or monarch butterfly, *Anosia plexippus* Linn., were received from Mrs. Edw. B. Rogers, Southport, who wrote that these butterflies were extremely abundant and lighted upon maple and other trees. These butterflies often migrate in large numbers and there are several accounts in entomological journals where swarms have passed the night on trees and shrubs.

Giant Water Bug.—On July 19, Mr. Pierrepont B. Foster of Hamden brought to the Station a large aquatic bug which had attacked and killed a gold fish in his pool. This bug was *Lethocerus americanus* Leidy, known as the giant water bug or electric light bug. It is aquatic during its immature stages but when it has reached the adult stage, it often leaves the water and flies about arc lights at night. It is predaceous in all stages.

European House Cricket.—On April 14, specimens were brought to the writer from an apartment house on George Street, New Haven, of the European house cricket, *Gryllus domesticus* Linn. (See Plate XXIII, b). This insect was said to be extremely abundant in the basement of the building. The individuals could be found in the cracks and crevices of the masonry walls and the tenants were greatly disturbed on account of the infestation. After conferring with the writer, the owner made applications of some prepared roach powder with a blower, and reported that the treatment seemed to be successful.

The Birch Leaf Skeletonizer.—This insect has continued to be prevalent and has skeletonized the leaves of gray birch trees throughout the State. Other species of birches were attacked but were not so conspicuously brown as were the gray birches. The injury was about the same in 1923 as in 1922, and is caused by a small moth called the birch leaf skeletonizer, *Bucculatrix canadensisella* Chambers. The life history of this insect has not been completely worked out. It is the larvae feeding upon the leaves which cause the injury, and if choice shade trees are sprayed with lead arsenate late in July or early in August, this injury will be prevented.

Spruce Leaf-Miner.—On May 7, spruce twigs were received from the F. A. Bartlett Tree Expert Company of Stamford, the leaves of which had been mined by the spruce leaf-miner, *Recurvaria piceaella* Kearf. Descriptions and life history notes regarding this species may be found in a paper by W. D. Kearfott in the Journal of the New York Entomological Society, Vol. XI, page 151, 1903. It is said to attack red spruce in the New England States and black spruce in northern New Jersey. The larva is red on dorsal lateral and ventral surfaces, with a dark green patch on the dorsum of each abdominal segment. Head and thoracic shield, pale brown. No remedy is known.

European Pine Shoot Moth in Connecticut.—On November 24, Mr. Filley brought to the laboratory from Ridgefield, some twigs of red or Norway pine, *Pinus resinosa*, which had been deformed and the buds eaten in the manner caused by the European pine shoot moth, *Evetria buoliana* Schiff. No insects were found in this material, but on October 13, twigs of the same species of pine injured in the same manner were received from Tarrytown, N. Y., containing two brown larvae which we were able to identify as *E. buoliana*. The larvae destroy the buds and this induces the lateral shoots to grow, and many of them become curved, twisted and distorted. Though it seems to prefer the red pine here, it also attacks other pines especially the Scotch, white, Austrian and Mugho pines.

The Box Leaf-Miner.—On November 23, specimens of box twigs were received from the Harkness Estate, Waterford, infested with the box leaf-miner, *Monarthropalpus buxi* Labou. The infested leaves were somewhat curled and showed on the upper surface some indications of irregular mines within. On dissecting, the upper epidermis separated easily from the lower and there were many small whitish green maggots between the layers as is shown on Plate XXIII, a. Dr. Garman visited the place a few days later with a view to studying the insect and testing control measures, but the conditions were not quite suitable for this purpose. The remedies recommended are to spray the foliage thoroughly about May 1 with a miscible oil, one part in 20 parts water, to which is added one pint of 40 per cent. nicotine sulphate per each 50 gallons of mixture. This treatment should be repeated about a week later. In Maryland, success was obtained by spraying the foliage at the time the adults emerge, with molasses diluted one part to three parts of water, this mixture entangling the flies as they emerged or before laying eggs.

Apple and Thorn Skeletonizer.—Full information regarding this insect may be found in Bulletin 246 of this Station, issued in June, 1923. During the season of 1923 there has been abundant opportunity for observing the work of this insect, which has now spread over the entire State. Professor A. E. Stene, State Entomologist of Rhode Island, informed the writer that the pest occurs in Rhode Island. The writer observed injury to apple trees beside the highway in going between Westerly and Providence, R. I., on August 16, which he attributed to this insect. At a conference in Boston, Mass., August 17, apple twigs injured by it and collected on the Massachusetts north shore were shown to the writer. Therefore it has spread throughout southern New England in three or four seasons.

The latter part of July during the summer meeting of the Entomologists of the Northeastern United States, which was held in Connecticut, the apple trees between New Haven and Hartford were brown from the feeding of the larvae of the second brood. Certain trees near New Haven, however, were not so seriously injured as in 1922.

Swarms of the Chain-Dotted Geometer.—On the evening of September 27 and for a few nights thereafter, swarms of thin whitish moths gathered around the "white way" lights in the center of New Haven. The attention of the writer was called to the matter by one of the newspapers, and on investigation the insect was found to be the chain-dotted geometer, *Cingilia catenaria* Drury. Smaller numbers of these moths were found during the daytime clinging to lamp posts, the walls of buildings or on the sidewalks. The caterpillars of this moth feed upon the leaves of

bayberry and sweet fern, when abundant, often defoliating these shrubs. They are slender yellowish larvae, with two conspicuous black spots just above each spiracle, and dorsally striped lengthwise with faint narrow lines. When fully grown they are from one and one-half to one and three-fourths inches in length. The pupa is enclosed in a loose net fastened to the leaves. The moth has a wing-spread of about one and one-half inches, is white, with chains of black dots across the wings. Larva, pupa and adult are shown on Plate XXIV.

Flight of Cotton Moths.—On September 12 and 13 there were swarms of cotton moths, *Alabama argillacea* Hubn., in New Haven, Bridgeport, Stamford and doubtless other cities and towns of the State. They fluttered around the stronger lights during the night time and in day time were resting often head downward on the plate glass store windows, walls of buildings and lamp posts. Similar flights have been noted in former years, and in the Report of this Station for 1911, page 339, and for 1912, page 217, are notes regarding the appearance of this moth in Connecticut in those seasons. The moth is a uniform light reddish brown with white discal spots on the fore wings. When resting the wings are folded in the shape of a double roof (Λ) and the moths present a trim and attractive appearance. The caterpillars are known as "cotton worms" in the southern States and are not known to feed on other plants. In some seasons they are extremely numerous in the cotton States, and the adults migrate northward often in enormous numbers and are sometimes reported from many of the northern States and Canada, usually in September and October. This insect is not known to hibernate in the United States, unless possibly in Texas. The adult is shown on Plate XXIV, d.

A Japanese Weevil in Connecticut.—On July 29, 1920, Messrs. Zappe and Walden while inspecting nursery stock in a nursery in New Haven, collected some curious fat brown weevils which were new to the Station collection, and which were unfamiliar to Mr. Zappe. Mr. Zappe collected more of the same species on July 26, 27 and 30, 1921, and on June 24 and July 21 and 27, 1922. Mr. Walden also collected one specimen on July 21, 1922. In 1923, some collecting was done in the vicinity but no specimens of this weevil were obtained. Specimens were sent to Mr. H. C. Fall, who replied that it was probably introduced from some other country. On May 15, 1922, the writer took some specimens to Mr. E. A. Schwarz at the U. S. National Museum, Washington, D. C. Mr. Schwarz stated that the species was not represented in the National Museum and that it might be difficult and take considerable time to identify it. On May 28, 1923, Mr. Zappe took some specimens to the American Museum of Natural History in New York City and left them with Mr. A. J. Mutchler, who said

he would show them to Mr. C. W. Leng and possibly between them they might be able to fix its identity. Not succeeding, Mr. Mutchler afterward sent it to Dr. G. A. K. Marshall of the British Museum, London, who replied in part as follows:

"The insect is, as your information suggested, a Japanese species, *Pseudocneorrhinus setosus* Roelofs. I am not aware, however, that anything has been recorded with regard to its habits or life history. I trust that it has not yet established itself in the United States."

According to the observations of Mr. Zappe, the adults feed upon the leaves of burr marigold, *Bidens* sp. So far we have been unable to obtain any information about the immature stages of this insect. The adult is shown on Plate XXIV, e.

Authorship.

For bibliographical purposes all notes and articles in this Report (Bulletin 256) should be credited to W. E. Britton, except where otherwise indicated.

Illustrations.

The illustrations in this Report (Bulletin 256) are from the following sources: text figures are all from drawings as follows: Fig. 9, map drawn by A. E. Moss, shaded by Stoddard Engraving Company; Fig. 10, drawn by B. H. Walden; Fig. 11 drawn by Philip Garman; Fig. 12 after Howard, Bulletin 25, Bureau of Entomology, U. S. Department of Agriculture; Figs. 13, 14 and 16 after Smith, New Jersey Agricultural Experiment Station; Fig. 15 drawn by L. H. Joutel. The plates are all from photographs from the following sources: XXI, c, and XXII, b, by R. C. Botsford; XI, a, and XIII, by W. E. Britton; XIX, a, XX, c, and XXII, a, by Philip Garman; X, b, by G. H. Hollister; XIV, XV and XVI by J. Leslie Rogers; XVIII, a, by Bureau of Entomology, U. S. Department of Agriculture; all others by B. H. Walden.

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a. Field insectary at Station Farm, Mount Carmel, at the time of the Entomologists' field meeting.

b. Enlarged insectary at Station.

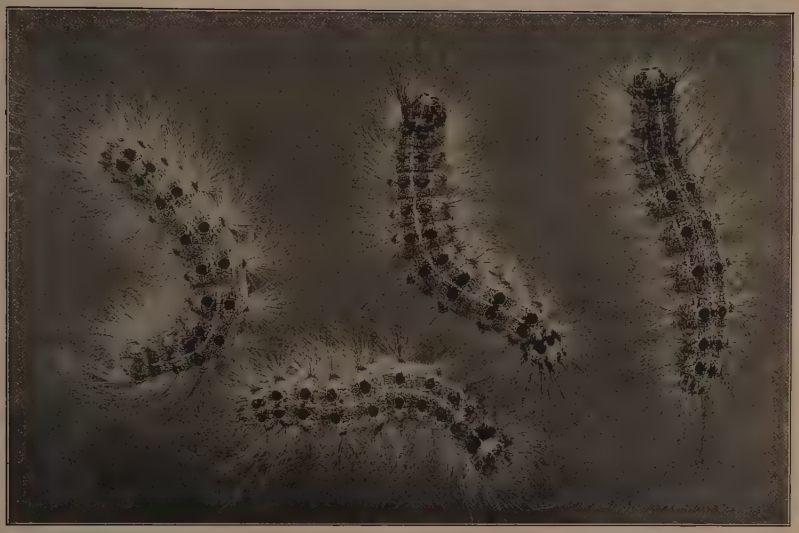
NEW EQUIPMENT.

PLATE X.

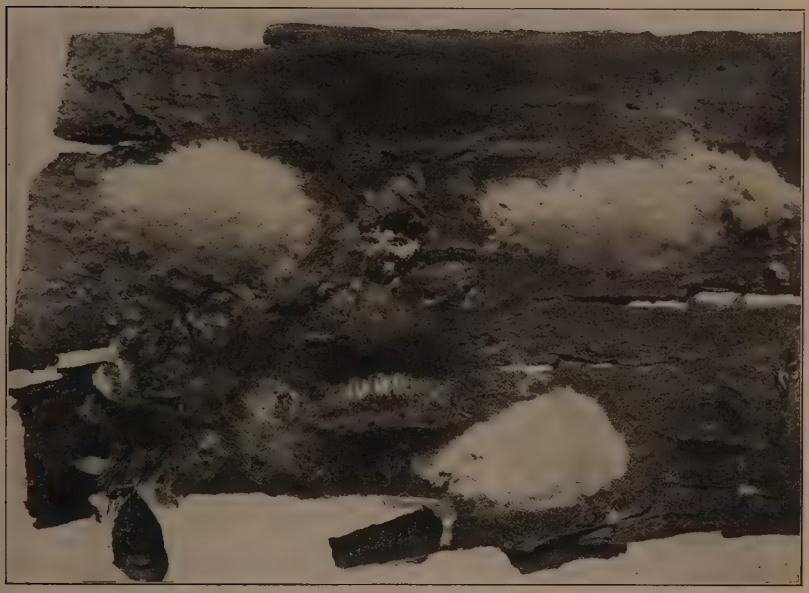
a. Female and male gipsy moths. Natural size.

b. Treating an egg-mass with creosote.

GIPSY MOTH CONTROL WORK.



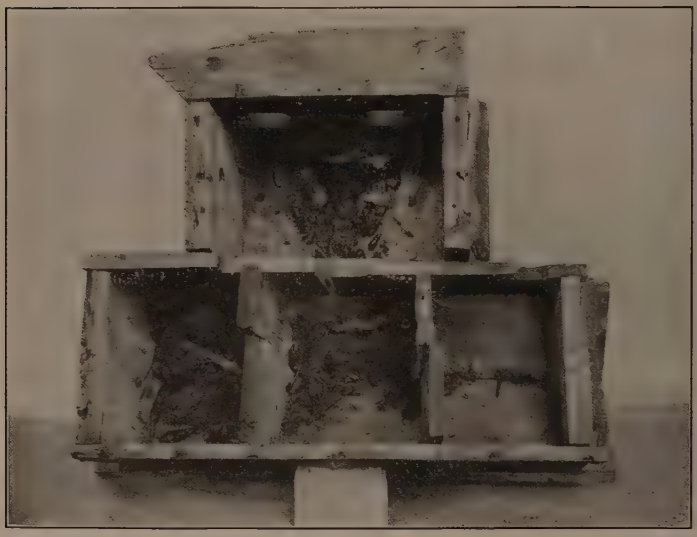
a. Gipsy moth caterpillars. Natural size.



b. Egg-clusters and pupae on inside of loose hickory bark.

PLATE XII.

a. An innocent looking bird house.



b. Inside of the bird house containing about 107 cocoons and 35 egg-masses.

a. View in garden where first infestation was found in Connecticut, Groton, November 10.

b. Another view in same garden.

EUROPEAN CORN BORER.

a. Burning weeds and rubbish with Federal burning truck, infestation No. 1, Groton.

b. Burning weeds and rubbish at infestation No. 2, Groton.

a. Weeds at infestation No. 2, Groton, before burning.

b. View of same field after burning.

EUROPEAN CORN BORER.

PLATE XVI.

a. Burning corn stalks with the aid of oil applied with hand sprayer, infestation No. 1, Groton.

b. Burning weeds with power outfit, infestation No. 2, Groton.

a. Slight injury to ear of sweet corn, Groton.

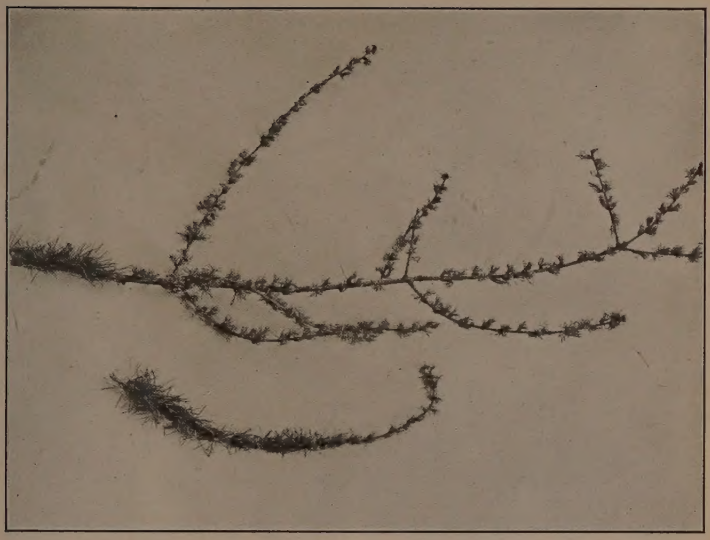
b. Female, male, larva, pupa and burrow in cornstalk. Slightly enlarged.

EUROPEAN CORN BORER.

a. Infested peach cut open to show larva. Somewhat enlarged. (After Quaintance and Wood, Bureau of Entomology, U. S. Department of Agriculture.)

b. Peach twigs which have been injured by the larvae. Natural size.

ORIENTAL PEACH MOTH.



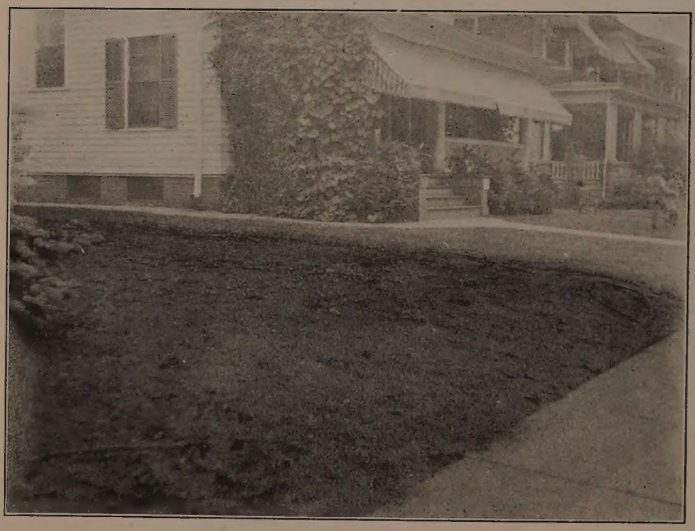
a. Appearance of injured leaves in June.

b. Winter cases fastened to twigs, four times enlarged.

LARCH CASE BEARER.

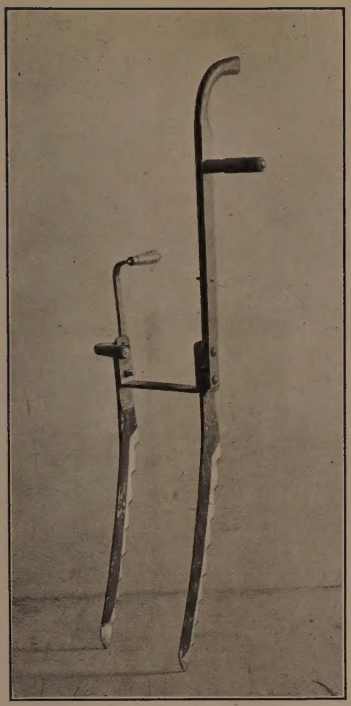
a. Adults showing variation from light brown to black, twice natural size.

b. Larvae or grubs, twice natural size.

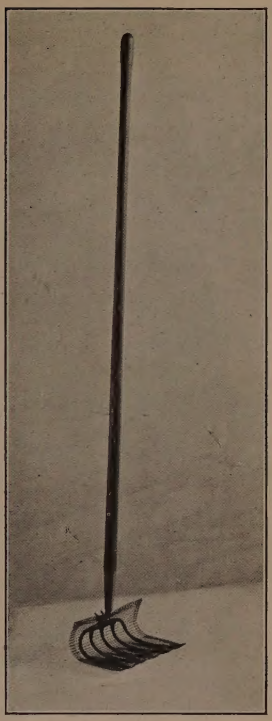


c. Lawn injured by grubs. Grass has been killed in the foreground but back towards the house it is uninjured.

ASIATIC BEETLE.



a. Modified hay knife for recutting ditches in salt marsh.



b. Potato hook with prongs covered with wire netting, for removing mud from ditches.

c. Installing a metal culvert through a sand beach to drain the marsh beyond, Westbrook.

PLATE XXII.

a. Broken dike, Stony Creek.

b. New dike, Stony Creek.

MOSQUITO ELIMINATION WORK.